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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Phil Bates, John R. Anderson, and John A. Mc Dermott

Application No.: 09/179,332 Group Art Unit: N/A

Filed: October 27, 1998 Examiner:

For: MULTI-USER COMPUTER SYSTEM

Commissioner for Patents
Washington, DC 20231

DECLARATION OF KEVIN MORRISON

I, Kevin Morrison, declare and say that:

1. I was formerly employed by an affiliate of the assignee of the present application as President. I refer herein to the assignee and corporate entities affiliated with the assignee collectively as "C-C-C Group." I make this Declaration to disclose pertinent facts pertaining to dealings between C-C-C Group and a customer (hereinafter "Customer Corp.") located within the United States. At the times mentioned below, I was President of the business unit responsible for the dealings between C-C-C Group and Customer Corp., and was responsible for overseeing such dealings on behalf of C-C-C Group.

2. At the time of such dealings, I was familiar with common industry practices in design and construction of computer facilities and systems.

3. During 1996, C-C-C Group was advised by Mr. Jay Garthwaite, then a consultant to Customer Corp., that Customer Corp. was interested in constructing a new, large-scale computer

facility, commonly referred to as a "server farm" which was to include thousands of servers and hundreds of individual work stations and computers. At that time, C-C-C Group was selling a product referred to by the trademark "FreeDesk" which allowed a single user to be connected to a single computer remote from the user's location.

4. During September 1996, C-C-C Group submitted a proposal (hereinafter "Proposal") to Customer Corp. A true copy of that Proposal (with the name of Customer Corp. redacted) is annexed hereto as Ex. 1. Later in September 1996, C-C-C Group submitted a quotation (hereinafter "Quotation") to Customer Corp relating to the system contemplated by the Proposal. A true copy of that Quotation (with the name of Customer Corp. redacted) is annexed hereto as Ex. 2.

5. I did not regard the Proposal and Quotation, taken separately or together, as amounting to an offer that could be accepted so as to enter into a contract for sale of a system to Customer Corp. Rather, I regarded these documents collectively as an initial suggestion stating what type of system C-C-C group could ultimately develop for Customer Corp. I expected that these documents would require further clarification and negotiation. *Inter alia*, the Proposal and Quotation did not set forth factors such as when the system would be developed or when the various amounts set forth in the Quotation would be due. In the context of a large-scale system development and integration project as contemplated by the Proposal, factors such as the development and schedule and payment schedule are essential to an understanding between the parties.

6. To the best of my knowledge and belief, neither I nor anyone else acting on behalf of C-C-C group provided clarification of the proposed development schedule and/or when

payments would be due in accordance with the Proposal and Quotation until October 28, 1996, when the document entitled "[redacted] Project Plan October 28, 1996" was presented. A true copy of that document (with the name of Customer Corp. redacted) is annexed hereto as Ex. 3. The Project Plan included a section entitled "Commercial Milestones" directed to the development schedule and payment schedule. Prior to October 28, 1996, the consultant acting on behalf of Customer Corp. had provided the same or similar milestones to C-C-C Group, apparently with the intention that C-C-C Group would include those milestones, or some milestone at a similar level of detail, as a part of a more detailed proposal by C-C-C Group to Customer Corp. C-C-C Group did not present such a more detailed proposal until it presented the October 28, 1996 Project Plan.

7. An invoice (C-C-C (USA) Inc. Invoice No. 1870) dated October 14, 1996, was issued to Customer Corp. The copy annexed hereto as Ex. 4 is a true copy of such invoice, except that the name of Customer Corp. has been redacted, and the handwritten notes on the copy were not on the invoice as presented. That invoice refers to a deposit of "10% of total contract value." However, no contract was in effect at the time. The invoice states that the amount would be payable "upon the presentation of project schedule, agreed systems specification and agreed payout milestone document, currently scheduled for October 28, 1996." To the best of my information and belief, the invoice was issued by C-C-C Group in the hope that if the Project Plan of October 28, 1996 was acceptable to Customer Corp., Customer Corp. would make an initial deposit in the amount of 10% of the total price set forth in the Quotation.

8. Customer Corp. did not accept the October 28, 1996 Project Plan as a definitive, formal contract between the parties. Instead, there were extensive negotiations between

Customer Corp. and C-C-C Group towards the goal of reaching a definitive contract for the design, development and construction contemplated by the Project Plan.

9. Customer Corp. apparently came to believe that the project as set forth in the October 28, 1996 Project Plan, in some form or another, with or without modifications and changes, ultimately would prove worthwhile, and Customer Corp. wished to expedite the preliminary development work called for in the October 28th document. Accordingly, on or about November 18, 1996, Customer Corp. paid the amount of $359,245 referred to in C-C-C Group Invoice 1870 (Ex. 4).

10. To the best of my information and belief, despite extensive negotiations toward a definitive, formal contract, no such definitive, formal contract was ever executed. Instead, C-C-C Group continued with the design, development and installation, and from time to time issued invoices for work done to Customer Corp.

11. The system to be constructed under the October 28, 1996 Project Plan was a system that had not been built or tested as of October 28, 1996. The "commercial milestones" set forth in the Project Plan specifically called for a development program, with continued review by Customer Corp. Thus, at no time did C-C-C Group have the authority to unilaterally design and deliver a system as set forth in the October 28, 1996 Project Plan.

I further state that I have been warned that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and such willful false statements may jeopardize the validity of the application or any patent resulting therefrom. I state that all statements made of my own

knowledge are true and all statements made on information and belief are believed to be true.

Dated: 10TH SEPTEMBER, 2001

K. V Morrison

Kevin Morrison

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EXCLUDED BY OTHER AGR.

EXHIBIT 1

1. EXECUTIVE SUMMARY

This proposal suggests more than asked for. More functionality, more planning, more expansion, more vision. The design uses video to present a slick and professional image to the market. Using leading-edge technology customers and prospects will see a very high technology operations center using the most advanced screens, video electronics and software available.

It does not end there. We suggest that your engineering staff's idea of using the video meeting system to manage remote sights and to give support more efficiently and at less cost is excellent. It demonstrates that the principles are right and the objectives are sensible.

The wall in the operations center can display not only video channels, a trivial task, but display test signals [from existing test software], remote diagnostics [transmitted in from Guadalajara base station], linking into the marketing truck using the video meeting system. Senior staff can make presentations over the meeting system direct to the marketing truck without reaching for their passport! Management time can be spent doing core activities instead of traveling. The wall can be used to present a unified image of stunning presence.

The user interface is simplicity itself. Using advanced windows management new users can quickly and easily become confident with the new technology. And with simplicity of operation comes popularity. people want to use it. The ability to sit at a desk, at any location with the necessary installed cable plant, even without a resident PC, press a keyboard key or move a mouse the server video is made available, after security issues are satisfied of course. The video need not be restricted to the server domain. The design is not dedicated to particular system. It can accept video inputs up to 1024x768 resolution. This might even be extended.

The video matrix and video engine design grows with your demands. As more and more users are added buffered video expansion slots allow these users to access bigger and bigger video matrices.

C-C-C believes that this design, not only of the video switch but also of the overall system approach, is innovative and addresses not only the tactical brief set but also helps to deliver a strategic platform that can build their vision on for the future.

2. INTRODUCTION

is the spearhead of the corporation. They deliver the network that supports the drive into multimedia, including the Internet. The support infrastructure required is enormous. The range of services to be accessed by developers, clients, management and support personnel not only has to be provided, it has to be anticipated before it is needed. It has to be in place ready for when the demand comes. The demand for video based information is growing daily. People want to see what is happening, now. Not only do they want to view their computers they want to see their colleagues, situations as they happen, enabling them to plan ahead, to react immediately to events before they unfold.

All buildings are pre-cabled allowing voice, data, video as well as the regular utilities to be delivered on demand to user's position. The cabling is designed in a manner that allows expansion and contraction of requirements to be supported almost immediately. Video is not a regular requirement. The main difference from voice and data is that the user sees the quality of the signal. This is unlike voice and data when a degree of degradation can pass unnoticed. Video also differs in the varying degrees of bandwidth requirements needed. The issue is that video signals themselves differ enormously. A baseband signal, for example, is only 6MHz wide whilst an RGB signal is approximately 60 - 200 MHz wide. It is absurd therefore to describe systems as being capable of merely supporting 'video'. It is a blanket word with no accurate description attached. To enable video of differing bandwidths to be selected randomly for reception and display at a user's position it is necessary to install differing hardware for each bandwidth.

This document is concerned with the following elements of requirements:

- **High resolution video switch**
- **Video meeting and TV delivery system**
- **High Resolution Wall system**
- **Integrated GUI management system**

The main advantage of the design, other than the technical elements, is that the system to deliver the server video is part of a strategy. It is not a standalone system. It is designed to integrate with both existing and additional operating platforms. The central management platform resides on an NT platform. The client end is platform independent. Users have the option to have access to the following services from a single management platform:

Item	Description	Function
1.	Hi-Res Video Switch and associated components	Delivers a 1024x768 video signal [s] to client positions, on demand, with a single mouse and keyboard controlling multiple video streams.
2.	Video Meeting system	Sets up video meetings, file transfer, application sharing, directory services on the fly.
3.	TV Delivery System	Integrates with [3] above delivering up to 79 channels of TV to the user's position down one RJ45 [include 3 above].
4.	Hi-Res Video Wall	Takes in video feeds from both baseband and Hi-Res [up to 1280x024], digitizes them and then sends them to the video wall.
5.	Common GUI & Management Platform	The GUI is structured using framework classes allowing additional applications to be easily introduced or removed. A single GUI residing on the desktop PC gives users access to each available system under all management conditions.
6.	API	The Application Programmers Interface is currently being enhanced to include the latest technology, including the Hi-Res video switch. This adds a further dimension to management possibilities particularly with increased integration with existing

3. DESIGN OVERVIEW

The design is based on discussions held between Com Group, and C-C-C. During discussions four immediate requirements were identified:

- **High resolution video switch**
- **Video based meeting system**
- **High resolution Operations Center video wall**
- **Integrated GUI management system**

The system has to be installed by week four '97. The system delivers video from a central location [baseband and high resolution] over installed cable plant using RJ45 plugs and sockets. The display options depend on the video resolution being received.

The **video switch** delivers video from servers to user desk positions located within 150mtrs [500ft approx.]. Each user can select their video[s], or have it pre-selected, using a PC where the system GUI resides. Levels of security are included. An output of the switch can also be routed the video engine wall controller. This allows group discussions on the data being displayed. This is the core of the design and represents the most exacting demands of both hardware and software integration.

The **video based meeting system** is a video conferencing system that through the API enables automation of group activities as well as enhanced workflow. There are the normal facilities included; file transfer, application sharing, multi-point and etc.

The **high resolution video wall** delivers video based information than originates either on a PC, UNIX, TV, CCTV, or any other video based service. The image is digitized and then displayed on a video wall, a flat screen video wall no more than three inches in depth.

The **integrated GUI management system** delivers the level of control and automation both for the system manager and user alike. Tabs are used to select the platform and then buttons pressed to achieve the effect.

4. HIGH RESOLUTION VIDEO SWITCH [SWITCH]

4.1 Introduction

The high resolution video switch is a video matrix with inputs from servers [or PC's and etc.] and outputs that ultimately are connected to the user. The system is modular in that it can expand both at the input [servers <64] or by the number of connected users [<320]. The system is classed as 'non-blocking.' This means that any user can access any server's video without restriction. Control of that video is a feature of the management system. A matrix can be expanded to accommodate numbers greater than 320 if necessary.

A matrix is made up of 9U high chassis, 19" wide. Cards are installed to enable video input feeds to be connected from the servers and also inserted to enable users to access the matrix. When a matrix has been created it has therefore a finite number of inputs [servers] and outputs [users].

4.2 System Components

The video switch system consists of the following hardware components:

1. **Chassis & Backplane**
2. **Power supply**
3. **Control card**
4. **Server Card**
5. **Matrix Card**
6. **RJ Fanout System**
7. **Mouse/Keyboard Switch**
8. **Helper PC**
9. **System Server**
10. **User receive unit**

4.2.1 Chassis & Backplane

The chassis and backplane are supplied as a single unit. The chassis is 9U high [16" approx.] and 19" wide. It has on slot for a controller card, four slots for server cards [< 64 servers] and sixteen slots for matrix cards [< 320 users].

4.2.2 Power Supply

The power supply is located at the bottom of each cabinet. It is a linear supply feeding the required voltages on to each of the backplanes via directly connected cables. Cooling fans are integral to each supply.

4.2.3 Control Card

The control card provides control of the crosspoint switch via control signals on the backplane. The card also accepts four data streams containing sixteen multiplexed channels from the four server cards. These streams [containing all the mouse and keyboard signals from all the connected servers/PC's etc.] are then compressed by the control card and presented to a high speed interface to the server controlling the switch. The input and output ports [1xRS232; 2xRS422; 1xHigh Speed] are all RJ++ series connectors.

4.2.4 Server Card

The server card accepts signals from the structured wiring in FreeDesk format [i.e. three pairs for RGB and one pair for the mouse and keyboard control]. The video signals are buffered and presented to the switch backplane as well as to a high density connector located on the front panel. This connector is used to slave the sixteen server ports to an additional matrix when users exceed the initial matrix threshold of 320. The video is presented as single ended format. The keyboard and mouse signals are decoded and sent in a single multiplexed stream to the control card for transfer via a high speed link to the mouse/keyboard matrix switch.

4.2.5 Matrix Card

This card contains the matrix electronics enabling users to be routed to their selected video. The cards can either route the user to a video resident on the chassis directly via the backplane or route the video path via daisy chained matrix cards to another video present on a further video matrix chassis. In this way users can gain access to a video stream located on other chassis.

4.2.6 RJFanout System

The Fanout system consists of a chassis, control card and double-width [8HP] cards. The chassis is logically located at the end of the matrix but physically located in another nineteen inch cabinet. The incoming cables from the matrix cards are connected in at the rear of the chassis. It takes these high density feeds from the last matrix card and presents them as twenty RJ45 ports positioned as two groups of ten side by side on the front of the card. Cable plant interconnections are positioned above and below these chassis allowing users to be neatly connected through to the matrix switch.

4.2.7 Mouse & Keyboard Switch

This chassis performs two functions:

1. **Routing of keyboard and mouse signals from correct input to correct output.** Although this mirrors the operation of the matrix switch, it I independently controlled. There are two bi-directional data ports, one connected to the fan-our chassis (connected to keyboard and mice) and another connected to the input cards (connected to servers). Each of these links is a high speed multiplexed data stream, and routing is carried our in the switch by transposing different packets in the multiplex. The switching and routing function is specified and controlled by the server over an RS422 link.

2. **Data transfer to the C-C-C server.** A copy of the incoming (from mouse and keyboard) data stream is presented to the C-C-C server so that the server may monitor keystrokes from users and initiate an appropriate response.

4.2.8 Mouse & Keyboard Connection sequence

The following is a sequence of events that explains the management of the relationship between the mouse and the keyboard:

1. User presses a key, the keypress travels through the RJFanout card [User cards] to the keyboard/mouse switch.
2. The keyboard/mouse switch sends the keypress data to the C-C-C server.
3. The C-C-C server connects the relevant user [ID in the keypress] to a 'helper' PC by controlling the matrix switch.
4. User is now connected to a PC so that video for their 'LOGON' screen and keyboard/mouse control appears.
5. On completion of 'LOGON' helper PC sends message to C-C-C server to switch the relevant MSN server and to disconnect the user from the 'helper PC' ready for the next user.
6. User is now connected to requested system server[s] and carries on working normally.

4.2.9 Helper PC

This PC runs an authentication package (written by C-C-C), which provides an easy method of server selection for the user. Its function is just to provide the initial contact with the user when a keystroke is first entered. When a key is initially pressed, the keystroke will be passed to the C-C-C server via the high speed keyboard/mouse multiplex. The C-C-C server will recognize this as an unattached user and connect the user to one of the helper PCs. The user will therefore be presented with the initial screen of the helper PC which will ask for login details. The authentication package will collect details on the user and security, and if all conditions are satisfied will instruct the C-C-C server (over the LAN) to switch the user through the matrix switch to the required server, freeing up the helper PC for the next asynchronous user keystroke.

4.2.10 System Server

The C-C-C server, controls the matrix switch and the keyboard/mouse switch. It communicates with helper PCs over the LAN so that user details may be transparently collected, and has access to all keyboard and mouse data from users (through the keyboard/mouse multiplex). The server also holds configuration details for the system with an internal map of servers connected, the capabilities of those servers and a map of currently logged users.

4.2.11 User Receive Unit

This is the active electronics unit positioned under each user's PC's monitor. RJ45 patch leads connect between the sockets of the desktop unit and the cable plant. The desktop unit has sockets [i.e. RJ45 and 'D' type connectors and Din connectors] for the installed cable plant as well as sockets supporting connection to each of the video terminals , mouse and keyboard. It is proposed that each piece of hardware [i.e. mouse, keyboard and video screens] connect directly into the desktop unit. There are additional connectors and internal electronics contained in the receiver box. There are D' type connectors for video [for video/TV system connection] as well as the PC's mouse and keyboard connections. *This configuration therefore combines the two receiver functions required at the desktop to support:*

- ⇨ **Video switch delivery [n+1 video, mouse & keyboard]**
- ⇨ **TV/CCTV/Video Meeting Interface to the PC**

5. SOFTWARE CONTENT AND SPECIFICATIONS

5.1 Introduction

The strategy adopted by C-C-C for the control of the installed video systems is to have an open systems approach with client server architecture. Space on the desktop is at a premium. The GUI is therefore very compact, dealing with a plethora of system controls. The management system is developed and supported by C-C-C personnel. This means that the degree of functionality can be altered to suit our client requirements.

There is a single GUI that manages all of the available systems. It connects to the user over the existing LAN. Each installed piece of hardware includes a software based management system. The interface to the architecture is shared between each system. The exact details of the management system have not been agreed. However for the purpose of this proposal it is agreed that assumptions are made to facilitate rapid progress.

To assist rapid progress the makes assumptions about the existence of certain hardware as well as the method of working used by Microsoft Developers for which this solution is initially being generated.

5.1.1 Interface to the Proposed C-C-C Switch Server

The following document goes into a little more depth about the interface between the local NT domain server and the C-C-C Switch server as far as security is concerned. It is assumed that a developer logs into his local workstation, authenticated by the NT domain server. On entry the OS could automatically run the Switch Server client which asks the switch server to switch through the required resources (in this case the cabinets). The allowable cabinets would probably be represented by a list from which the user can select the desired ones.

It should first be explained how the client could obtain this list. On start-up, the client would connect to the C-C-C switch server. It would then request a list of allowable resources for that user and domain. The switch server would hold a list of domains entered via an admin. interface. This would marry users and domains to particular cabinets. When a new cabinet resource is created on the server, it would start a new Access Control List (ACL) associated with that resources. The ACL would list the users or domains that have access to that resource. Given a particular resource, the Switch server could traverse the ACL to see if a particular user is authorized to use it.
When the switch client connects to the Switch Server, the connection implicitly implies who the user is as he / she would already have had to log onto the NT domain server in order to access the client. All the server has to do now is traverse the ACL for each cabinet to see if the user is allowed access to it. If access has been granted then the machine name or id could be returned to the switch client for presentation to the user.

The technique above ensures that the full security measures offered by NT is maintained and only cabinets that have been granted access rights to a particular user or domain would be presented to that user.

5.2 Controlling access to shared resources within Windows Network

A standard problem which occurs within client-server systems is the secure access to some shared resources. By secure we mean that the clients must have undergone an authorization process and that there exists some security mechanism which can be used to determine if a given client has the right to access and use a given resource.

By shared we imply that there may be occasions when clients attempt to make use of a resource which is not capable of servicing further requests. Such circumstances arise time and again with devices which can be used by only one user at a time; e.g. a printer can service requests from many user but only one user may be printing at any instant. To stretch this example further, we may have a pool of printers in an organization which may be dedicated to individual departments or project teams. We may wish to employ a security mechanism which would not allow members of the accounts department to print to printers in the marketing department. We may however want to give the heads of each department the right to print to any available printer.

The question is how do we produce a generic way of controlling access to shared resources assuming that we are in a Windows NT domain? Let us also assume that client systems may be any mixture of 3.11 / 95 / NT systems. To answer this we must make use of two concepts. The first is named pipes and the second is the security API in windows NT.

This solution assumes that the software mediating access to the shared resources is hosted on the Windows NT operating system.

5.2.1 Named Pipes

A named pipe is a one-way or two-way pipe for communicating between a server process and one or more client processes. A server process specifies a name when it calls the CreateNamedPipe function to create one or more instances of a named pipe. All instances of a named pipe share the same pipe name, but each instance has its own buffers and handles and provides a separate conduit for client server communication. When a client process specifies a pipe name in the CreateFile or CallNamedPipe function, it connects to an instance of the pipe. The use of instances enables multiple client processes to use the same named pipe simultaneously.

subject to security checks, any client process can access a named pipe, making it easy to communicate between related or unrelated processes. Named pipes can be used locally to communicate between processes on the same machine or across a network to connect processes on different machines.

5.2.2 The Security API

This allows for the secure access to shared objects within an NT domain. For each shared resources, we create a corresponding object within the address space of the mediator. Each object will configured to have the same access permissions as the real world resources. So we may have three printers on our hypothetical network and for each we would have an object within the mediator. Attached to each object is an access control list (ACL) which holds access control entries specifying which users or groups of users have permissions on each printer. The user and group id's are exactly those defined by the domain controller. In order to make use of this information, the mediator will have an administration tool which will allow us to create, modify and destroy resource objects. The GUI for this tool will allow for the definition of rights on each resource in terms of the domain controllers users and groups.

In order for this development to proceed, we must investigate the use of named pipes and the security API.

5.3 The Scenario

The current understanding is that developers sitting at a particular location would want to access up to five workstations, control of which could be selected by keyboard selections. At present it is assumed that the developer has a full NT based PC on the desk and would need to take control, using a single mouse and keyboard, of five video streams from a selection of seven hundred video sources. The management platform resides on the PC.

5.3.1 Security

One of the main issues is with security. The following restrictions are examples that are being implemented as options in the absence of a more details security specification.

Only developers belonging to a certain domain would be allowed access to a particular bank of workstations. It will also be assumed therefore that developers have already been assigned unique user-names and have been allocated particular project groups. This information would be held on the existing NT Server and hence access rights could be obtained from it using the NT Security API.

5.3.2 Details - diagram

The diagram above shows one user located at the Developer Workstation having access to 5 shared Workstation resources, the output being displayed on the 5 monitors on the desk. The small dashed lines refer to connections made by the C-C-C Hardware Switch connecting monitors to the remote workstations.

5.3.3 Authorization

Before a workstation can be connected to a developer it must checked against the existing user groups set-up in order to determine that the request is from an authorized user. As the developer's PC is assumed to be running NT and is connected to NT server, any user logging in would have been already authenticated once the C-C-C Switch Client software is run. The switch client software would present the developer with a menu that would allow him to choose available workstations. The available workstations allocated to that developers project group could be requested from the C-C-C Switch server which would have obtained the information from the Local NT Server on the network via the Security API. Hence, when the client software requests that a particular workstation be connected to the user, the server can be sure that that user has already been authenticated.

The C-C-C Switch Server can now send control signals to the C-C-C Hardware Switch to perform the required connection.

5.4 Assumptions

As mentioned above, this scenario makes a number of assumptions and these are summarized below.

1. **The developer has an NT workstation at his location through which a particular shared workstation is requested.**
2. **Hardware exists that will be able to patch a large number of inputs to a large number of outputs.**
3. **The hardware switch should be able to cope with users requesting connections to remote workstations simultaneously (this could be resolved by having a number of switch servers which would automatically be allocated to users requesting switching)**
4. **The whole set-up would be connected to an existing LAN on which is an NT server having knowledge of users and user domains. This information could be passed to the C-C-C Switch server through the security API.**

5.5 Conclusion

Based on the assumed the task would be fairly straight-forward from a software point of view given the available time-scale of January 1997 release date . It is envisioned that three software modules would have to be written:

1. **C-C-C Switch Client** - presents the user with a menu of available workstations to which he can connect to or disconnect from.
2. **C-C-C Switch Server** - Accepts requests from the client and instructs the hardware to patch the required ports together.
3. **Administration software** - To allocate shared resource workstations to particular project groups.

6. OPERATIONS CENTER

6.1 Introduction

The system is made up of a set of modules that together create a novel approach to the display, management, utilization and maintenance of a multichannel operations center. By creatively applying the existing technology developed by C-C-C MSN are able to demonstrate that they are in total control of their medium [video] as well as running a leading edge system management and display platform.

6.2 System Design

The proposed system design consists of the following elements:

- ⇨ **Head End**
- ⇨ **Baseband video switch**
- ⇨ **High Resolution Flat screen Video Wall - Gas Plasma**
- ⇨ **FreeVision TV Distribution & Video Meeting System**
- ⇨ **System Management**

6.2.1 HeadEnd

The Headend gathers together each of the individual baseband channels. These can originate from any baseband feed [i.e. TV, CCTV, Terrestrial, Satellite, Video Conferencing and etc.] placing them on a single RF pipe. These are all analogue channels with an initial capacity configuration for thirty channels. The output of the RF pipe can be remotely controlled and monitored [using a modem] as well as adjusted on the site by each channel [frequency and signal level settings].

The output of the headend is therefore a number of channels placed on a single RF band ready for onward connection not to the main video wall but connected to FreeBand for internal building distribution using the installed twisted pair cable. The video is then displayed on the selected monitor or video wall screen.

6.2.2 Baseband video switch - Supporting Channel Expansion

As the overall channel capacity increases, through digital channel facilities as well as organic growth, the operations center needs to display more and more of these channels as well as manage and support them. The current method of direct connection of each channel to a dedicated monitor in the wall limits channel expansion capability.

By introducing a method of switching to the design the manager is now in a position to select at random or in a set sequence channels to be displayed on the main wall. As the overall channel capacity increases these are merely supplied to the switch for either connection to the headend or onward connection to the video wall. Channels are connected through to the headend when users within the building require access to them through FreeBand.

6.2.3 Flat Screen Video Wall

The proposed video wall is composed of forty Fujitsu gas plasma displays. The 21" gas plasma screens are used to fill two roles. The primary objective is to display chosen high resolution or baseband channels as part of a general monitoring function.

Map Displays

Maps resident on an NT platform can be routed through to the wall from the high resolution wall controller. These maps can have intelligence embedded into them. These 'labels', when activated, carry out an allocated task. For example a label over New York, when pressed using a mouse, may activate a video meeting with NY, open up site files and carry out a maintenance call. This is a simple example of a variety of applications that the system can be extended to.

6.2.4 Wall Display

The wall display can be made up from a variety of feeds; NT, TV, Video Meeting and etc. The feeds can also be a mixture of standards. These can be pre-configured, scrolling through a set sequence. For example CCTV feeds may be switched on every evening at a certain time. Different cameras may be automatically switched on to the wall display via movement sensors.

6.2.5 Leading Edge

The secondary aim of the flat screen wall is to present a 'leading edge' management system to any personnel visiting the center. This is achieved using imagery. Firstly the screens present a striking image. When installed with highly polished borders, beveled to catch reflections, there is a distinct visual impact.

Secondly system managers can, using the video wall electronics, take video inputs from a variety of sources. One source may be from a PC or workstation running the software based test equipment or map information. The test software or map can be digitized and displayed on to the flat screens a single image. The video wall is now being used to display information that currently resides on the PC or workstation as a single image.

6.2.6 FreeVision TV delivery and Video Meeting System

The FreeVision system The **FreeVision™** Video Business Meeting System enables the user to configure a series of 'Smart' buttons containing registered usernames or TV channels. It provides video manipulation capabilities, for example, the ability to select a self-view - to check your camera output - or a complete information list on registered users in a Directory style interface.

The User Interface contains the functionality associated with Windows. The "System Menu", which is common to all applications compatible with Windows, provides several options including 'Minimize', 'Restore', 'Close' and 'Move'. The 'About' option in this menu holds the version information needed for any support calls to C-C-C on our free 24 hour Technical Support line 0800 834439 (UK) or direct Help Desk line +44 (0) 1849 467968.

On-line help is available as a push-button option on the main GUI. This allows quick and easy access to on-line help documentation, into which walkthrough tutorials are also incorporated.

All push-button features have textual labels for identification purposes. The larger push-buttons may also have graphics to facilitate speed of recognition. The graphical interface improves the quality of Human-Computer Interaction (HCI) and provides a good way of overcoming natural-language barriers.

Features which are unavailable at any point in time will be de-activated (grayed-out) until the user reaches a point in the conference where the feature becomes accessible.

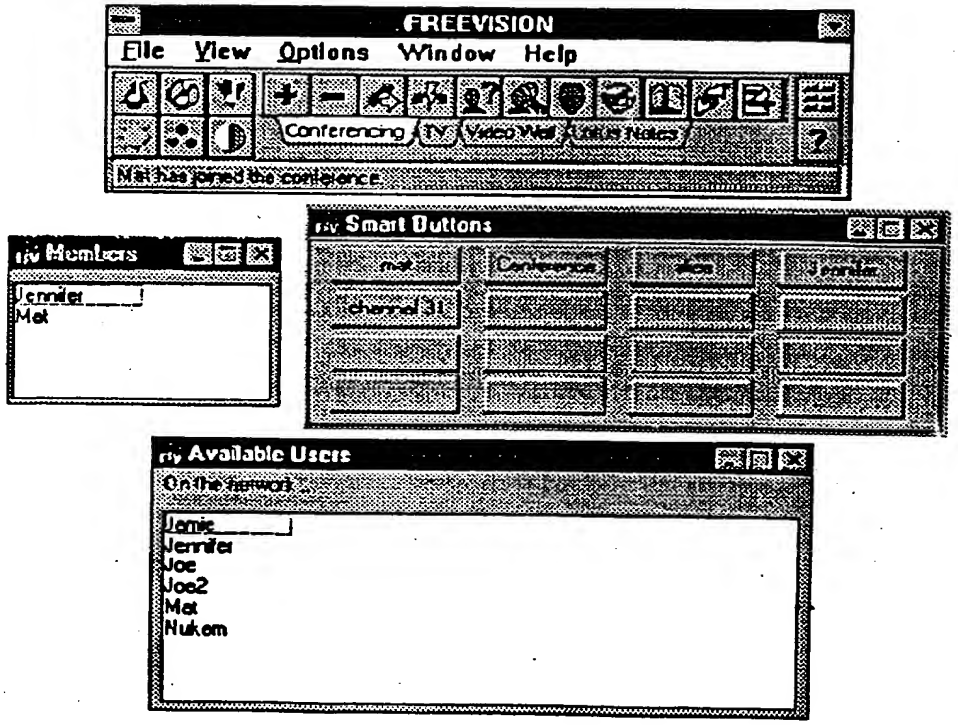
6.3 System Management

C-C-C has taken a strategic view in the development of this element of the system. Rather than building standalone control units for each system being controlled one is intended for several if not all systems being managed.

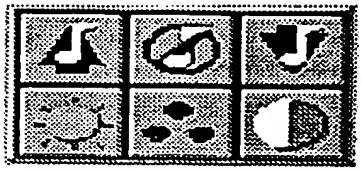
This is a GUI-based front-end which allows videomeeting between two or more registered users. It sends a signal to a central server which in-turn process the incoming message and re-routes it to the appropriate machine.

6.3.1 FREEVISION System - Common User Interface

The GUI is designed to expand with the introduction of new equipment. For example the display offers the user control of four separate systems. As each command is required an icon is selected. On selection the command pad pops up giving the user access to the next level of control. An additional tab may be created that is dedicated to remote testing. Software would be written that interfaces with the test equipment direct from the control panel giving extra command and flexibility.



6.3.2 Functionality



FREEVISION™ General Controls - allow the user to adjust the picture quality of the on-screen video or audio output. The control function applies to both video business meetings and TV delivery.

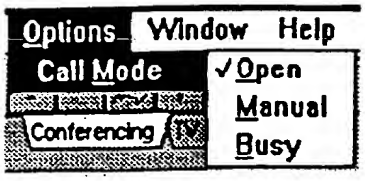
Volume up - enables the user to raise the level of the audio.

Mute volume - blocks all audio output from the workstation. The user continues to remain in the conference, with live audio and video links from the other conference participants. This is a useful option in the event of an urgent call on your telephone or someone needing to speak with you in confidence.

Volume down - has the reverse effect to the above function by decreasing the level of audio.

Brightness - controls the level of brightness to achieve the best quality picture within the video window.

Color - adjusts the color of the video output on screen to create a natural picture.



Answer Mode Menu

- incorporates three possible answer modes by which calls may be accepted. These can be altered by the user at any time. Each answer mode allows calls to be answered in a different way. These are:

Open - While the software is set to *Open* mode all audio/video calls placed to the user will be automatically answered, resulting in live audio/video links being established.

Manual - Calls placed to the user when the answer mode is set to *Manual* may be 'screened'. An *Incoming call dialogue box* pops up on the user's screen containing the call details, for example, the name of the user placing the call, the time and the date. The user can decide whether or not to participate in that particular conference.

Busy - *Busy* mode will block all incoming calls. Those wishing to contact another user will receive notification that he/she is busy. This is ideal if the user does not wish to be disturbed.

Help Button

- the software interface is equipped with a comprehensive on-line help facility. This provides step by step explanations of the software's functionality. A set of user tutorials is also incorporated in the on-line help to provide further assistance in a structured format. In the event of a user requiring further technical support, a *Freefone Help-line 0800 834439* (UK) and *Video Help Desk* is available 24 hours per day, 7 days per week.

FREEVISION™ Video Meeting Toolbar

Add user

- allows the user to place calls to other users by selecting their name from the list of registered users. It also permits the addition of TV channels from the list of subscribed channels available.

Remove user

- allows the user to remove him- or herself from a conference. It can also be used to remove other members from your own conference, if necessary without closing down the entire call.

Call transfer - is enabled when in a point-to-point call. The user can transfer the other session member to another user. Regardless of how the call originated, the person to whom the call is transferred becomes the meeting owner upon acceptance of the call.

Hang-up - terminates the call. If you are responsible for creating the call the entire conference will be closed down; if you are an invitee in someone else's conference, you will simply remove yourself from the call.

Connected users - displays a list of the users currently connected to the system.

Meeting members - provides a list of members currently taking part in a conference.

Self view - allows the user to check their video image either before or during a conference. A single click either activates or deactivates this function.

Mute video - blocks all video and audio output from the workstation. The user continues to remain in the conference, with live audio and video links from the other conference participants. This is a useful option in the event of an urgent call on your telephone or someone needing to speak with you in confidence.

Directory Services - allows the user to open their on-line address book which contains all their contact user details. Calls can also be placed to their potential conference partners from within this function.

	*Share Application*	- allows a user to share any application on their PC, which is compatible with Windows, with the other conference members. The other members do not need a copy of the application being shared on their PCs as it is driven solely from the sharer's PC. The application may be amended by the sharer whilst in conference. Various annotation tools exist within the videoconferencing system which enable the conference participants to highlight areas to be amended or discussed. These tools are available on all of the participants' screens.
	*File Transfer*	- allows any conference member to transfer entire documents to the other conference partners. This provides each of the partners with their own individual copy of the document.
	*Smart Buttons*	- allows a user to place either a video call to another partner, or choose a TV channel by clicking a single button (bearing the name of the C-C-C user).

6.4 Directory Services

Directory Services is a GUI-based front-end to a database of user information.

To activate Directory Services, the "Directory" push-button on the GUI must be pressed. The Directory Services displays detailed information on registered users, e.g. address, e-mail or fax number. An integrated photo field verifies that you are talking to whom you intended, highlighting yet another security feature of the FREEVISION™ Video Business Meeting System.

- Directory Services

Quick access to users is available using the alphabetical tabs located at the bottom of the interface enabling access to individual user information. Additionally, a scrolling feature allows the user to view multiple entries.

Tool tips appear just below the buttons when the cursor is held over the button area for a few seconds, in a similar manner to standard Windows® applications.

Directory Services has full Windows® capabilities. Version information is displayed on a splash-screen when launching Directory Services.

A conference call can be made from Directory Services via the Dial push-button on the main window.

6.4.1 Application Sharing

A feature of the GUI, Application Sharing is accessed from a push-button along the toolbar of the user interface. It is depicted by an icon of a hand-shake.

When the Application Sharing button is chosen a window will display a list of all applications that are currently running on the local PC. Once an application is selected, an image copy of it will appear on the screens of all the conference members.

The original sender retains control of the shared application. The recipients see an image which they can annotate to highlight specific areas. The original sender can scroll, close, open and change parts of the shared application which will, again, be seen on the recipients' screens.

6.4.2 File Transfer

File Transfer is accessed from a push-button on the toolbar of the User Interface. It is depicted by an icon showing a file with an arrow.

When the transfer option is chosen a file selection window appears. This is similar to the "File/Open As" option in Word. Once the correct directory and file have been chosen the OK button is clicked. Using MS® Windows V 4.0 and Windows '95, the native look and feel of the software will be applied to FREEVISION™.

Each conference member will see the percentage rate of the file being transferred on their local interface. Once the transfer is complete each conference member will receive a "Save As" window. When the file has been saved in the desired directory the user has the opportunity to view the file immediately.

Unlike Application Sharing, within File Transfer a copy of the file is actually transferred to all the conference members. One condition applicable to this option is that the application that is needed to open and view the file must be resident on the members PC.

6.4.3 Software Integration

Further enhancements are possible. For example when the map is displayed on the wall labels can be displayed as well. Each label can have embedded intelligence activated using the mouse.

Using the Application Programmers Interface [API] we can link between the FreeVision management system [video wall, video meeting, TV distribution and etc.] and the application running. Labels can then be created that allow 'hot-key' access between systems.

For example a label when activated using the mouse may call up a remote base station [the label is the name of the base station] on the FreeComms video meeting system. The video meeting is displayed on one of the available screens that form the video wall.

6.5 Video Uplink

It has been indicated that possibly wide area communication links are available using the uplink facilities of the satellite. This gives central office the ability to communicate on a video, audio and data level with other remote users. For example the marketing truck can communicate with Paris wherever it is. This may be useful to conference in celebrities, pictures of the central command room,

6.6 Application sharing & Remote Testing

The video conferencing system has the ability to transfer files and share applications. We use this ability to transfer and share information available on a LAN architecture with interested parties in the quickest possible time, regardless of their location. Some of the existing video test equipment in use by support staff is software based mounted on a PC.

Using the 'application share' facility from the video meeting system engineers can look at test information generated by remote sites. As well as look at resultant test information on a channel they can 'conference in' that channel so that they can see the video quality themselves in addition to analyzing the test data. Engineers would be in a position to carry out remote maintenance down to the second level of servicing.

6.7 Audio/Video Displays

The video selected can be displayed on:

- **PC's or UNIX workstations [TV & App. sharing]**
- **TV's and Monitors [TV only]**
- **Flat gas plasma [TV & app. sharing]**

The resultant video from the management selection is displayed on the screen or video wall or both. To view the shared data application [i.e. maps, databases and etc.] currently a high-res screen is required as well as a PC or UNIX platform. Using the control panel users can select video and data based information as required independently of each other or have the selection made for them by a central control.

6.8 Remote Users

Remote users are personnel positioned at locations external to the main headquarters. Typically these are existing offices, residential, mobile units [e.g. marketing truck]. Remote users may have some or all of the following equipment:

PC or UNIX operating platform
Video screen for general audience viewing
Additional camera for general audio video input
Complete FreeComms desktop video facilities additional monitor facility
Printer
WAN connections [minimum 128k ISDN line]

6.9 Central Communications Room

Located within the computer / communications room is the main hardware and software of the combined FreeVision system. This comprises of:

Mounted inside 19" cabinets:

* FreeComms video switch
* MEDOS UNIX server
* WAN Gateway
* FreeBand TV delivery system
* Structured wiring interlinks
* Interconnections to the TV Crosspoint switch
* FreeWall scaling engine and combined video switch
* Headend Equipment
* High Resolution Video Matrix System
* Windows NT Server

Not mounted inside 19" cabinets:

* Flat screen video wall
* SUN workstation
* Operator's station [PC or UNIX]
* Operations manager's station [flat screen]
* Embedded Map Intelligence
* User Access Units, cameras and linear power supplies

6.10 In-building Distribution

Personnel within the building can be given access to the video meeting and TV delivery system over the installed twisted pair cable plant. The user can be allocated video by connecting into the single RJ45 socket at his PC position anywhere in the building. Presentation of the video is platform independent. Users have the ability to view the information prevalent in the central operations room in real time, assuming access rights are granted.

7. HIGH RESOLUTION VIDEO SWITCH

7.1 Video Wall System Functionality

The high resolution video wall takes inputs from the widest possible selection of video sources. This means that the wall can be used to display not only TV feeds from the satellite but also from PC's and Workstations. This allows corporate presentations to be viewed on the screen at the same time as TV, video conferencing or any other video source.

The FREEVISION™ Video Wall consists of a matrix of flat panel screens driven by a high resolution switch. The following information describes the tools needed and the role in which they play in the creation and operation of the FREEVISION™ Video Wall.

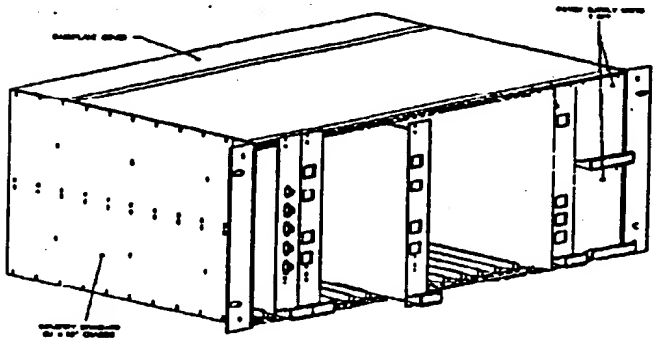
7.2 Video Scaling Controller

The scaling controller consists of a number of plug-in cards each having its own distinct function. The Video Input Card accepts the analogue RGB input from the host computer or workstation or from one of the high resolution video inputs on each Video Output Card, and provides digitized video data to a variable number of Video Output Cards. Each of the output cards is capable of driving two display screens, and video walls of different sizes can be created by populating a greater or lesser number of Video Output Cards. A System Controller Card, receives command instructions from the host computer via a bi-directional RS232 communications link and is responsible for overall system initialization and control.

7.3 FreeWall Chassis

The chassis consists of a standard 6U high 19" rack providing capacity for dual power supplies, processor and monitoring card plus 16 option slots. Each card forms a module of physical height 6U and width 4HP allowing up to 16 modules in a full width rack. A 2 x 2 screen video wall, for example, would require a total of four cards, one Video Input, two Video Output and one System Controller Card. A maximum wall size of 6 x 5 is supported in one chassis, although multiple chassis may be concatenated to support a wall of any size.

A fan tray below the rack provides cooling for all the cards in the rack.



7.3.1 Video Input Card

The video input card accepts a single video input for scaling and presentation as a large display over multiple screens. The single video input can be via 5 BNC connectors (Red, Green, Blue, Horizontal Sync, Vertical Sync) which will accept all sync options and combinations, or from a backplane connection to any of the input ports on the output cards. The sync type and polarity will be automatically detected. This makes the standalone controller compatible with all types of PC and workstation.

The incoming image is digitized producing a 16 bit (5 red, 6 green, 5 blue) digital stream, which is then further demultiplexed before being transmitted across the backplane as 64 bit wide high speed digital video. The input card also handles sync locking and generation of master clocks for the rest of the system.

Two front panel LEDs show the presence of sync signals and valid mode detection for the incoming video.

7.3.2 Video Output Card

Each of the Video Output Cards can drive two color displays, providing scaling and image manipulation functions. The output resolution is selectable from a minimum of 640 x 480 to a maximum of 1024 x 768 non-interlaced. High horizontal refresh rates up to 80 Hz can be generated to avoid display flicker and all sync options can be provided to maintain compatibility with a wide range of display types. The output is presented via a standard RJ45 (FREEVISION™ TV Delivery compatible output, multiplexed sync and polarity). The card also provides a video input (FREEVISION™ TV Delivery format) for each output port, which may be either switched directly to the output, or patched through to the Video Input Card. In this way a number of FREEVISION™ TV Delivery compatible high resolution video inputs may be connected to the wall controller and either displayed directly on an output screen or used as the scaleable input. This functionality allows the wall controller to stand alone in some installations without requiring support from the high resolution video switch. The video input differs from a standard FREEVISION™ TV Delivery RJ45 in using the pair normally used for remote power as an audio input pair. A separate converter provides conversion from FREEVISION™ TV Delivery composite+audio to the FREEVISION™ TV Delivery component+audio to allow standard TV signals to be used as inputs both to the direct screens and the scaleable wall input.

The scaling is performed by real time video resizing engines which can yield smooth image magnification and reduction by independent horizontal and vertical scale factors using FIR filters of up to 33 taps. This technique preserves fine detail, avoids blockiness and gives far more acceptable results than pixel replication or bilinear interpolation.

The common border between neighboring displays in the wall will unavoidably present an inactive region of the wall and the segmentation can take account of this in two ways. Either the parts of the image falling into these inactive regions can simply be lost, or the image presented on each display can be reduced in size slightly to accommodate these border strips. The second method will undoubtedly lead to certain types of image discontinuity, but may often be preferable, for example, when presenting motion video

7.3.3 Aspect Ratio

Aspect ratio correction can also be handled in two different ways. An incoming image of resolution 1280 x 1024, square pixel, has an aspect ratio of 5 : 4 whereas a video wall constructed of CRT display tubes will retain the aspect ratio of those tubes, which is typically 4 : 3. The difference can be made up by stretching or shrinking the image horizontally or by having a background border visible at each side of the image. The controller can offer either of these two methods and once again it may be the video subject matter which determines which is most appropriate.

7.4 Processor Card

The processor card provides a simple ASCII control protocol for the scaling controller via a front panel mounted RJ12 connector accepting RS232 protocols. Alternatively, controllers may be chained together using the two RJ12 front panel mounted connectors using RS422 protocol, allowing multiple controller displays to be simultaneously controlled. This card also contains the power monitoring circuitry for fuse and power supply status within the controller. The processor card also provides a FREEVISION™ TV Delivery output port on RJ45 for the common audio output. This output is automatically connected to the audio from the input which is being scaled by the wall controller, i.e. the audio output from the wall will always be that associated with the 'large' display.

7.5 Scaling Controller Specification

7.5.1 Video Input

Video Format	RGB Analogue + Sync on BNC, FreeView compatible input on backplane
Sync Compatibility	H & V, Composite, Sync on Green
Video Amplitude	0.7 V - 1.0 V p-p positive
Sync Amplitude	Separate Sync : TTL positive / negative Sync on Green : 0.3 V p-p negative
Termination Impedance	75 Ohms
Maximum Video Bandwidth	150 Mpixels / Sec
Maximum Resolution	1280 x 1024, 80 Hz frame rate
Interlacing	Non-Interlaced
Host Control of :	Sampling Resolution, H x V Horiz. & Vert. Aperture Position Sync Type and Polarity

Video Processing

Color Resolution	16 bits - 5 Red, 6 Green, 5 Blue
Segment Scaling	Real Time using up to 33 tap Horizontal and Vertical FIR filters
Host Control of :	Wall Size, Number of Screens Displayed Image Size & Aspect Ratio Border Color Segmentation Style

Video Output

Video Format	RGB Analogue + Sync on FreeView compatible output on RJ45, FreeView compatible input on RJ45 can be switched directly to the output
Sync Compatibility	H & V, Composite, Sync on Green
Video Amplitude	0.7 V p-p positive
Sync Amplitude	Separate Sync : TTL positive / negative

Sync on Green : 0.3 V p-p negative	
Source Impedance	75 Ohms
Resolution	640 x 480, 800 x 600 or 1024 x 768
Frame rate	Selectable to 80 Hz
Interlacing	Non-Interlaced
Host Control of :	Output Video Resolution & Frame Rate
Sync Type and Polarity	

8. SUPPORT SERVICES

C-C-C Group will provide all required client training and documentation, and the on-going support and maintenance services which are vital in making our client's enterprise network communications solution a resounding success.

8.1 Training and Documentation

C-C-C FreeComms and its user interface are highly user friendly and simple to learn. However, the C-C-C Group wants to ensure that each user has the opportunity to ask questions, and to fully understand the new technology which will change the way they do business. Comprehensive user on site training will be provided for a total of five working days and will include not only interface training but also server and video switch network management and administration training by qualified C-C-C Group personnel. Such training will be complemented by user guides, tutorial material and all necessary documentation.

8.2 Billing

C-C-C Group's FreeComms system can provide automated billing and call detailing services will provide an invoice, and will report on user activities. Clients may configure the system to provide regular centralised billing from the billing service, as well as a range of management reports upon request.

As this service may not be required it is an optional extra to the main contract but can be implemented as part of the project.

8.3 On-Going Support - Help Line

C-C-C Group will provide a customer service 'help-line' during normal working hours, Monday to Friday 8am to 6pm, within the clients geographic location.

8.4 Trouble Reporting

C-C-C Group will provide hardware, software and operational support via telephone, dispatch of service technicians, and/or on-site support.

All hardware, software, and services supplied components throughout the enterprise, will be serviced and maintained by C-C-C Group personnel or authorised agents. Upon notification of operational or equipment problems, C-C-C Group will acknowledge the problem and begin working towards resolution.

C-C-C Group will assign a trouble report number and co-ordinate the resolution by working with the customer by telephone, or by dispatching a technician to the site. The telephone number will be supplied to each site as that site is enabled.

8.5 Hardware Maintenance

C-C-C Group will furnish on-going support for remote diagnostics, first-level hardware maintenance, and network connectivity. An authorised technician will provide such support in the absence of C-C-C Group personnel.

8.6 Service Operation

C-C-C Group personnel will be available between the hours of 8.00am - 6.00pm Monday to Friday, within each server location. Normal maintenance and upgrades may occur from 6.00am to 10.00pm Monday to Friday, and all day Saturday and Sunday. However, users may request system access during these hours should service be necessary.

9. CONCLUSION

The approach taken to deliver in-house video services is not to focus on individual requirements for video applications but to concentrate on providing a municipal video overlay that gives users access to video where and when required.

At the core of the design is a hardware set-up that collectively allows users to request and be given access to a variety of video services as and when required. These can be HRS video matrix accessing servers, video conferencing, TV channels, visitor access using video conferencing directly with their company contact or even security applications to monitor the building.. Each system is co-located in a designated area with cable plant [twisted pair] access supporting the necessary distribution.

Traditional video conferencing suites can be set up dynamically. It is suggested that flat gas plasma screens are installed, with a camera, speaker and microphone. The access to the central video engine [and hence to video conferencing, TV, VCR's, cameras or any other video input/output] and the outside world via active allocation of bandwidth through the gateway. These are installed at vast discount to the traditional roll-around or fixed location options commonly used.

C-C-C offer a turnkey, flexible, strategic and scaleable video architecture for today's business environment.

5. FINANCIAL CONSIDERATIONS - US DOLLARS

FREEVISION EQUIPMENT PROPOSAL FOR

[redacted]

TV & VIDEO MEETING; VIDEO SWITCH; HEADEND & FREEWALL

Quotation No. Q 96446A REF:MSN1.DOC/PROPS 28 Sept. 1996

EXHIBIT 2

5.1 High Resolution Video Switch [HRS]

ITEM 5.1 High Resolution Video Switch			
Item	**Product Code & Name**	**Description**	**Qty**
5.1.0	Video Switch Chassis HRS-CH-01	9U high chassis with integral backplane. Accepts 1xControl card; 4xServer card; 16xMatrix cards.	11
5.1.1	Control Card HRS-CC-01	Provides control of the matrix via control signals on the backplane.	11
5.1.2	Matrix Card HRS-MC-20	Connects 20 users to the backplane forming part of the video matrix.	15
5.1.3	Server Card HRS-SC-16	Connects 16 servers to the backplane or any other video up to 1024x768 resolution.	44
5.1.4	Matrix Cable HRS-CC-16	High density interconnects between chassis. Two per matrix card [in/out].	11
5.1.5	Desktop Video Unit HRS-OC-6	Video overlay card and baseband video interconnection. Accepts 1xmouse & keyboard; 1xvideo switched in; 1xdirect connect to resident PC to superimpose video on to the PC	290
5.1.6	HPC HRS-HPC-01	HPC that enables users to connect to their server without having access to a desktop PC [for 'LOGON' purposes].	10
5.1.7	Mouse / Keyboard Switch HRS-KMS-01	Mouse and Keyboard switch that routes the mouse and keyboard in tandem with the correct server video stream.	1
5.1.8	RJFanout Card HRS-RJF-10	There are 2 RJFanout cards per matrix card presenting a total of twenty RJ45 ports [i.e. 20 users].	30
5.1.9	HRJ45 Chassis HRS-CH-RJF	6U high chassis that accepts one controller card and 20 HRS-RJF-10.	4
5.1.10	Linear Power Supply HRS-PS-01	Linear power supply located at the base of each 19" cabinet. These are daisy-chained to each chassis in the cabinet. The control card monitors the power supplies and gives out audible and volt-free contact information when needed	12
5.1.11	Delivery; Installation; commissioning; documentation & project management	The delivery & import duty is 5% of hardware value. The resources required to create an operational environment from delivery to final functional checks are included. A comprehensive project plan will be raised in tandem with the client on awarding of the contract. This will be executed by Danny Barr, the proposed project manager.	as required
5.1.12	Travel, accommodation and living expenses.	All expenses as required for the duration of the contract as detailed are included.	as required
Total High Resolution Video Switch: $ 2,242,850.00 including local taxes.			

5.2

ITEM 5.2 Freewall			
Item	**Product Code & Name**	**Description**	**Qty**
5.2.1	Freewall Chassis FW-16-CH	Standard 19" 6U high rack mountable enclosure providing capacity for dual power supplies, video input card, video output card, video scaling controller, monitoring and processing cards, i.e. a total of 16 option slots. The option slots are used to connect in the selected cards. Connectivity between slots is provided by a 800 MHz backplane.	2
5.2.2	Power Supply FB-01-PS	Auto ranging power supply located in the chassis. When two are connected they share loading only taking full load when a fault condition occurs.	4
5.2.3	Video Scaling Engine Card FW-01-VS	This card accepts a single video input for scaling and presentation as a large display over multiple screens. The video input can be directly connected to the front of the card(coaxial connectors) or via the backplane from the high resolution video input/output switching card.	2
5.2.4	Video Input/Output Switching Card FW-02-VI	This card has 2 input ports and 2 output ports. The 2 incoming signals offer a choice of input to the Scaling engine or they can be selected as outputs directly to individual screens. Each card can therefore support up to 2 Display monitors or 2 choices of video to the scaling engine for re-transmission to the video wall.	22
5.2.6	Processor Card FW-01-PC	The processor card is 3U high and executes all diagnostics and communication interfaces to the switch.	2
5.2.6	Software Management System FW-01-MS	Software management system and license to automatically control on the fly, the video wall content. Resides either standalone or as part of the MEDOS operating system.	2
5.2.7	Plasma Display FW-2170-PDS	FreeWall Plasma display modules arranged in a 1 x 2 format and configured using FreeWall control systems. ***2 screens are standalone units.***	42
5.2.8	Receive Module FD-01-RX	FreeDesk receive module with RJ45 input and VGA output. Located with each screen to provide video input conversion.	40
5.2.9	Freewall framework	Polished Stainless steel framework to house 8 x 5 array of Plasma screens, with fixings for wall mounting.	1
5.2.10	Delivery; Installation; commissioning; documentation & project management	The delivery & import duty is 5% of hardware value. The resources required to create an operational environment from delivery to final functional checks are included. A comprehensive project plan will be raised in tandem with the client on awarding of the contract. This will be executed by Danny Barr, the proposed project manager.	as required
5.2.11	Travel, accommodation and living expenses.	All expenses as required for the duration of the contract as detailed are included.	as required
TOTAL FREEWALL: $ 620,635.00 including local taxes.			

5.3 Headend

ITEM 5.3 Headend			
Item	**Product Code & Name**	**Description**	**Qty**
5.3.1	Extension Module Carrier UFG 601	Used to extend the capacity of a Basic Module Carrier (UFG 600) to cater for up to 12 channel processing units.	3
5.3.2	Power Supply/ Control Unit UFN 500	To Supply the needed Voltages to a max. of 12 Channel Modules and to tune the transmission parameters of up to 31 processing units.	6
5.3.3	Power Supply Module Carrier UFG 501	The Power Supply Module carrier UFG 501 mounts onto the Rack mount TGZ-10 and allows the PSU to be mounted.	6
5.3.4	Satellite Processing unit (Demodulator Modulator) VHF UFO 131/I	For the reception of satellite programs with analogue audio sub-carrier. All relevant parameters can be set from the central control unit. The module has a decoder interface which can also be used to access the modulator in the unit.	30
5.3.5	19"" Rack mount frame TGZ 10	Accepts 1 UFG 600, 1 UFG 602 or two UFG 601	6
5.3.6	Power/Data Interconnection Leads LSO-75	Connects Power and Data between Power supplies and Module Chassis	12
5.3.7	Broadband Amplifier VOS 65/F	35dB Gain slope and gain adjustable Broadband amplifier	1
5.3.8	2 Way Combiner EAX 22	Combines the output of the existing satellite feed with the output of the Head-End	6
5.3.9	Interface Cable HE-001	Cable used to interface between Audio Video Patch panel and Modulator Module	60
5.3.10	MISC	Miscellaneous Connectors and Cable	as req'd
5.3.11	Delivery; Installation; commissioning; documentation & project management	The delivery & import duty is 5% of hardware value. The resources required to create an operational environment from delivery to final functional checks are included. A comprehensive project plan will be raised in tandem with the client on awarding of the contract. This will be executed by Danny Barr, the proposed project manager.	as req'd
5.3.12	Travel, accommodation and living expenses.	All expenses as required for the duration of the contract as detailed are included.	as required
TOTAL-HEAD-END OPTIONS: $ 49,290.00 including local taxes.			

5.4 TV & Video Meeting system

ITEM 5.4 TV Distribution & Video Meeting System			
Item	**Product Code & Name**	**Description**	**Qty**
5.4.1	12 Slot Chassis & Backplane (6U/10.5" High) FB-60-CC	Accepts all the cards, 19" rack mountable. Sighted in the riser/computer room. Accommodates a maximum of 60 users. Requires FB-01PS	2
5.4.2	Switchmode, FB-01-PS	Load Sharing & Auto Sensing Power Supply that is Card mounted supply that fits in the chassis. There are two that operate in parallel. Each supply is hot-swappable	4
5.4.3	Power Monitor Card FB-01-PM	Monitors power lines to the system. Alarm functions include volt-free contacts for remote alarm facility and an audio alarm.	10
5.4.4	Software Control Card FB-01-SC	Receives and passes on to the selected tuner(s) control signals from the receive unit and management control system	10
5.4.5	Tuner Control Card FB-05-TC	6U card for 5 users. RJ45 cable socket. Mounts inside the chassis	10
5.4.6	FreeComms Camera unit FC-DT-01	ABS moulded unit that sits on top of the workstation or PC. Contains the Sony video camera lens, electret microphone and pre-amp, miniature loudspeaker, privacy switch and digital TV channel display	50
5.4.7	PC video overlay box FC-OB-01	External box that places the baseband video [i.e. TV & Video Conferencing] on to the screen of the workstation. Contains the video overlay electronics, advanced audio feedback suppression, video drive electronics to transmit the video over twisted pair and audio and video muting. Ancillary outputs are provided for composite video, line level audio for driving external screens and an output port for existing FreeBand TV users. Connection to the cable plant is via a single RJ45 socket. **Includes electronics for video receive from the matrix switch.**	50
5.4.8	FreeComms Chassis FB-60-CC	A standard 19" 6U high rack mountable enclosure providing capacity for dual power supplies, monitoring and processing cards and thirteen option slots. If no options are selected the chassis can support 64. The total number of users that can be sustained in each chassis is determined by the options selected during configuration. i.e. if a slot is used to connect in a quad card then 5 less users are supported. Connectivity between slots is provided by a 64 channel backplane.	11
5.4.9	Power Supply FB-01-PS	Auto ranging power supply located in the chassis. When two are connected they are share loading only taking full load when a fault condition occurs.	22

5.4 Contd.

Item	Product Code & Name	Description	Qty
5.4.10	Processor Card FB-01-SC	The processor card is 3u high and executes all diagnostics and communication interfaces to the switch. Communication to the card is the ASCII command line protocol via a front mounted RJ11/RS232 [single switch] or dual RJ12/RS422 interface for multiple hub control.	11
5.4.11	Monitor Card FB-01-PM	The monitor card is 3u high and provides visual and audio indication of power rail status, both PSU's and fuses in the chassis.	11
5.4.12	Switched Video Card FC-05-SC	The card is 6u high and fits directly into the chassis. There are 10 RJ45 sockets on the front face. Each user has 2 sockets. One is to receive the TV signals from FreeBand whilst the other delivers the selected baseband signal [either TV, video conferencing or both] directly to each user's desktop unit. One RJ45 is needed per user to transmit the A/V signal to the desktop location and act as the signal path for duplex conferencing.	10
5.4.13	Delivery; Installation; commissioning; documentation & project management	The delivery & import duty is 5% of hardware value. The resources required to create an operational environment from delivery to final functional checks are included. A comprehensive project plan will be raised in tandem with the client on awarding of the contract. This will be executed by Danny Barr, the proposed project manager.	as required
5.4.14	Travel, accommodation and living expenses.	All expenses as required for the duration of the contract as detailed are included.	as required

Initial Cost $ 284,425.00 including local taxes.
Each additional user: $3,000.00
This cost includes 79 TV channels as well as full video conferencing assuming valid licenses in place.

5.5 Video Conferencing System - Ancillaries

Item 5.5 Video Conferencing System - ANCILLARIES.			
Item	**Product Code & Name**	**Description**	**Qty**
5.5.1	Mixer Card / Logo Generator FC-MC/LG-04	The mixer card is used to create a single audio of 4 FreeComms users for each multi-point conference participant. Multiple cards are used to create larger multipoint conferences, i.e. 2 mixer cards create a single audio for up to 8 participants. When 3 users are in conference the spare quadrant is filled with a video company logo from flash memory. The fully automated audio mixing, balancing and echo cancellation gives simultaneous speech from each user.	3
5.5.2	128k Codec FC-CK-01	128k codec conforming to H320 standard. Fits into the Gateway.	10
5.5.3	WAN Gateway - 128kbits FC-WG-128	The WAN Gateway consists of a 19" rack, Processor card, CODEC and a promptus I-Mux. All units are hot swappable. The Gateway is controlled by the MEDOS software via the processor card of the video switch. Bonding of several ISDN lines for transmission rates above 128 KBits is not possible using this gateway.	3
5.5.4	WAN GateBond 384K Gateway FC-WG-384	A 3U high 19" enclosure providing 1 WAN connection at speeds up to 384Kbits. Network interfaces include X21, V.35 [RS466 control] and 6B ISDN calls using industry standard bonding protocol requires 1 Ethernet and 1 FreeComms video switch port.	3
5.5.5	MEDOS Server Software - UNIX FC-DIR-150	The MEDOS server software resides on a UNIX platform. All video conference calls are routed through the video switch via the RS232/422 link cable. External call are automatically routed through to the selected CODEC either directly or through the gateway or GateBond product. **150 user license**	1
5.5.6	Client for MS Windows3.x, MS 95, MS NT [INTEL] FC-WIN-01	PC based client for FreeComms server. Hot Key access to all available functions resident on the FreeComms system including multi-point conferencing, file and application sharing as well as access to 79 channels of TV. Used in conjunction with FreeGate WAN conferencing is available.	50
5.5.7	Directory Services FC-DIR-150	This PC based data application resides as part of the user's GUI allowing "hot-key" access to instantly create multi-point conferencing. Each record has a photo of the person as well as text based information. **150 user license restriction.**	1
Ancillaries as detailed: $ 97,650.00 including local taxes.			

5.6 Financial Summary - US Dollars

The following notes apply:

I. The following costs include project management, installation and delivery.

II. All local taxes are included @ 8%.

III. Documentation and commissioning is included.

IV. The overlay card for the matrix switch includes the electronics for the video meeting and baseband video delivery system.

V. All prices are in US Dollars converted from Pounds Sterling at an exchange rate of $1.55 to £ 1.00.

VI. The software development estimate is based on our experience of this type of project.

5.7 Summary

ITEM	DESCRIPTION	SUB TOTAL [$]
5.1	High Resolution Video Switch [HRS]	2,242,850.00
5.2	42 Screen Video Wall	620,635.00
5.3	30 channel Headend	49,290.00
5.4	TV Distribution & Video Meeting System	284,425.00
5.5	Video System Ancillaries	97,650.00

5.6	Software development: 1 man @ £ 800.00 per day. 6 men = £ 4,800.00 per day. Estimated 40 days development time = 40x4,800 = 192,000	297,600.00
5.6	**TURNKEY GRAND TOTAL as detailed: $ 3,592,450.00**	

VIDEO DELIVERY
PROJECT PLAN
PRESENTED BY
C-C-C

EXHIBIT 3

Project Plan 10/28/96

1. INTRODUCTION

This document is intended to give a formal overview of the entire CCC / project paying particular attention to detailed project time-scales and manpower issues.

This document will cover all issues as raised by both and CCC personnel as a result of the meeting held on October 11, and will provide answers to questions and issues raised subsequent to the initial proposal document.

The document will give a detailed description of both the hardware and software development programs which will encompass key development issues and assumptions.

This document includes a project plan complete with milestones and cut-off dates which C-C-C will adhere to. The overall completion date will be 15 March 1997.

As part of this document C-C-C have put forward a milestone based commercial schedule which has been produced in conjunction with the project plan for the complete project.

2. PROJECT TEAM

As well as the CCC personnel who have already been involved in the initial negotiations a high caliber development team has already been created to work on the project.

This project is currently running in parallel with on-going development of our Video Conferencing products and in conjunction with the imminent completion of a high capacity, low-resolution switch installation at Bear Steam's in New York.

With Danny Barr acting as Project Manager from a base in Seattle we hope that contact between appropriate personnel will be handled in the most efficient way possible. Any issues which arise as part of the on-going development will be channeled through Danny with regular feedback sessions planned to keep all developments in adherence with the project plan.

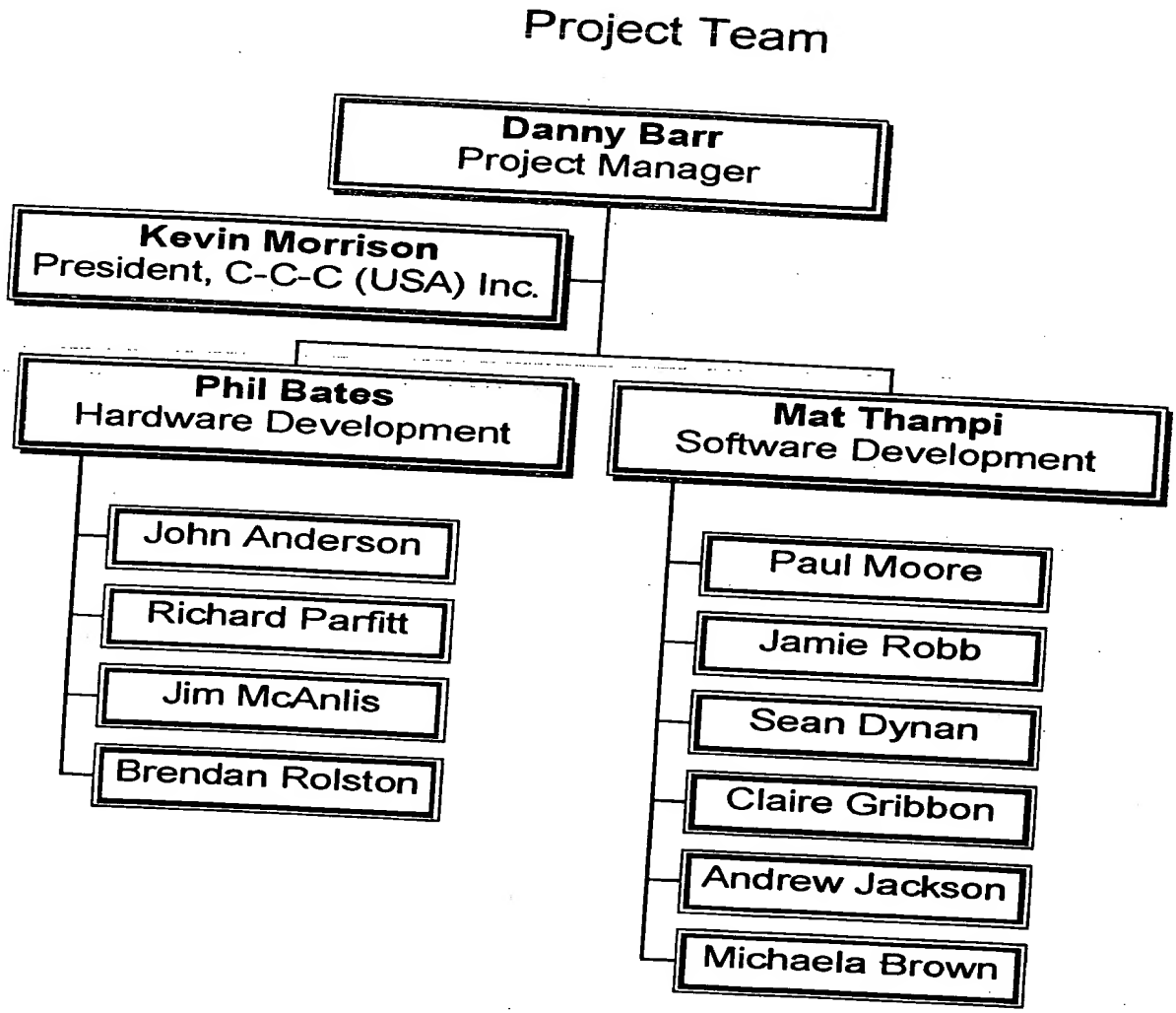
To expedite elements of the software development a small team of developers will be based in Seattle with the remainder of the development team based at the R&D facility in Antrim. We hope that this will enhance the Software development cycle and provide a quick response to any development issues.

The overall solution will be provided by means of 2 parallel developments.

Phil Bates will head up the hardware development team which will comprise personnel familiar with the relevant technologies on the Project. This unit has been responsible for all stages of the design to manufacture cycle for the FreeBand TV Delivery system, FreeComms Video Meeting System, FreeWall Video Wall, FreeDesk and Low Resolution Switching products. Since all these products have been taken from conception to manufacture by this hardware team we are confident that the progression of our current hardware to encompass the entire solution will be timely and efficient.

The Software Development team will be lead by Mat Thampi.
To date the Software Development team have coded the entire FreeVision system on both PC clients running various Operating Systems and UNIX Clients (IBM/HP/SUN).
This team has also been quick to accept new challenges and over the past 12 months have provided several new releases to meet customer specific requirements - including a port of the FreeVision Client software to both IBM A/IX and HP-UX.

2.1. Org Chart


Project Team
Danny Barr
Project Manager
Kevin Morrison
President, C-C-C (USA) Inc.
Phil Bates
Hardware Development
Mat Thampi
Software Development
John Anderson
Richard Parfitt
Jim McAnlis
Brendan Rolston
Paul Moore
Jamie Robb
Sean Dynan
Claire Gribbon
Andrew Jackson
Michaela Brown

2.2. *Key Players*

Kevin Morrison will be the main commercial contact point on the project.
Kevin has been with the company for 3.5 years and is a C-C-C main board member as well as President of the company's US subsidiary, C-C-C (USA) Inc.
He holds a degree in Business and Finance from West London University and holds several post-graduate qualifications in Marketing and Industrial relations.

Prior to joining C-C-C he worked for one of the UK's leading strategic Marketing consultants, specializing in the IT and Telecomms sector, where he held the post of Managing Director. Before joining this Agency he worked for the Festo Group of companies where he held several international sales and marketing posts during his 8 year tenure.

Danny Barr will act as overall project manager for the Project.
Danny joined the company outright 6 months ago but has had 4 years experience with the company acting as installation manager for joint CCC/Nortel networking projects in the UK
Danny graduated from the Queen's University of Belfast with an Honours Degree in Computer Science.
Prior to joining CCC he worked as a Network Administrator at Nortel's R&D facility in Belfast, Northern Ireland, handling all comms issues for the running of the 250 head facility as well as providing technical input for European wide computing and networking strategies Since joining CCC, Danny has managed the installation process for the US Video-Conferencing market as well as managing the Bear Steam's low resolution switch development and installation.

2.3. *Hardware Development*

Phil Bates is Development Manager for C-C-C Group and will manage the hardware development process for the switch. He has overall responsibility within C-C-C for hardware development strategy, design and implementation, and has occupied this full time position for two years, overseeing the design of FreeBand, FreeDesk and FreeWall. Before joining C-C-C permanently, he managed C-C-C development projects in his position as consultant at the University of York. He has held senior lectureship positions at the University of York and the University of Nairobi, and has twenty years experience in the industry, particularly in medical electronics and imaging where he held the position of Principal Engineer in the British Oxygen Company medical division.
Phil graduated in 1977 with a degree in Physics from the University of Bristol and also holds a Masters degree in Electronic Engineering from the University of Salford.

John Anderson is a Senior Hardware Consultant with C-C-C primarily working on the design of the desktop overlay unit. He will be the lead designer for the video and signal matrix component of the msn switch. He has many years experience in industry, working on video overlay technology, MPEG video encoding and decoding, interface (E1, T1, ISDN) design and video switching. Prior to working with C-C-C, he was Principal Engineer with Cirrus Computers designing high speed ASICs.
John graduated in 1978 with a degree in Electronic Engineering from Southampton University and is a member of the Institute of Electrical Engineers.

Jim McAnlis is a Senior Hardware Consultant with C-C-C, and has worked mainly on the design of the FreeComms switch and the Bear Steam's high capacity switch. He will be responsible for a large part of the mechanical design of the switch, together with the buffered output chassis. He has over twenty years experience in industry, primarily in Avionics and computer design, and has held lectureship positions at the Queens University and University of Ulster.
Jim graduated in 1970 with a degree in Electrical Engineering from the University of Belfast, and is a member of the Institute of Electrical Engineers and the British Institute of Management

Richard Parfitt is a Senior Hardware Consultant with C-C-C, and has been mainly responsible for the detailed design of FreeWall. He will work on the digital multiplex and switching of the keyboard and mouse data in the switch. Prior to working with C-C-C he has worked as a consultant on many aspects of high speed digital systems design, particularly digital image processing technology and ASIC design. He has also worked for Oxford Medical Instruments and Schlumberger on signal conditioning and processing designs.
Richard graduated in 1984 with a degree in Physics from Oxford University and is a member of the Institute of Electrical Engineers.

Brendan Rolston is a Systems Engineer with C-C-C Technology, responsible for the design of the FreeComms switch and desktop interfaces. He will work on some aspects of the video crosspoint matrix for the switch, together with network analysis of the video compensation paths within the switch. Prior to working at C-C-C he was a senior development engineer at Nortel technologies, working on high speed synchronous digital multiplexor design.
Brendan graduated in 1991 with a degree in Electrical and Electronic Engineering from Queens University and a Masters degree in Electronics in 1992.

2.4. Software Development

Jim Comerford is the General Manager of C-C-C Technology in Antrim. His responsibilities are to oversee and manage all of the Antrim Operation , People and Projects.
Jim is a Graduate in Computing Science, and is currently studying for an MBA.
His last post was with Compaq Computer Manufacturing in Scotland, where he was employed for 8 years. Throughout these 8 years with Compaq Jim had a number of roles , including Software Analyst, Network Manager, IM Project Manager and was involved in a number of large projects utilizing Microsoft products, NT/Windows 95/Back Office , including a roll out of 1500 Windows 95 PC's.

Mathew Thampi is the PC Development manager at C-C-C and will be managing the software development for the project. He graduated in 1988 with an honors degree in Aeronautical Engineering and a Masters in Computer Science in 1989. Mathew started work using 4GL languages and has moved through various stages of development from UNIX based C++ programming to Windows programming and has considerable experience with the Borland Delphi Development Environment having worked with it since it was released. His main activity was working as part of the team that developed and support the FREEVISION suite of products. He has been involved at all the various stages of software development from Object Orientated design and Analysis through to implementation and configuration management.

Mathew has also been responsible for the development of the C-C-C Gateway technology which allowed the video conferencing applications to communicate over ISDN.

Paul Moore is part of the software development team at CCC Technology Ltd. Since joining CCC, Paul has been involved in producing the FREEVISION common interface, VISITOR ™, and the VISITOR ™ Database Administration system.
Paul graduated from the Queen's University of Belfast with an Honors Degree in Microbiology and a Masters Degree in Computer Science and Applications. Prior to joining CCC he worked for three years at the University of Ulster at Jordanstown as Project Manager, Software Designer and Developer on two separate projects. The first project involved the design and implementation of a Parallel Database Machine based on the INMOS Transputer. This work was sponsored by the IRTU. The second project was based on the initial Transputer architecture and involved elucidating knowledge from non-deterministic systems using Bayesian analysis and Dempster Shaefer's theory for reasoning under uncertainty. This project was sponsored by the EPSRC.

Jamie Robb joined CCC as a software developer. His previous experience includes 2D and 3D games development, high speed graphics processing, multimedia development and digital signal processing, as well as technical support and customer service skills. Jamie studied computing at City University, London and at the University of Ulster attaining a Masters qualification.
Since joining CCC, Jamie has worked on various projects involving TCP/IP and ISDN as well as the design and development of the CCC video overlay unit.

Sean Dynan has had six years experience in software development and systems administration in flight simulation industry. He also spent two years development and account management in airport scheduling and aerospace simulation software. Prior to C-C-C he has been involved in Real time software development and Database Management systems development on PC, UNIX and proprietary O/S's. After joining C-C-C his areas of involvement include InstallShield for FREEVISION, integration of FREEVISION API with LotusScript for Lotus Notes (including development of sandwich DLL for FREEVISION API), Lotus Notes evaluation and replicated database development.

Claire Gribbon has been involved in the development of the video conferencing suite since its initial transfer from NYNEX. She has had considerable experience in both the PC and UNIX environment and is now exclusively working on the PC client side. Her main responsibilities are the software layers between the clients and the server and is at present writing a video conferencing API which could be used by client developers. She has also developed the main modules which were required for the ISDN gateway technology.

Andrew Jackson is part of the client-side software development team at C-C-C Technology. Since joining the company he has worked on producing the FreeVision interface and the Video Wall Manager software.
Andrew graduated from Aston University in Birmingham with an Honours Degree in Manufacturing Engineering and has worked for 2 years as an engineer in the automotive industry. Prior to joining C-C-C he also worked for 4 years as a research engineer at Aston University, developing object-oriented simulation software for the manufacturing industry. He has recently submitted this research as a Ph.D.

Michaela Brown joined CCC when it acquired Nynex Media Communications NI Ltd. in September 1995. Michaela graduated from the Queens University of Belfast with a Degree in Mathematics.
For three years after leaving university Michaela worked as a programmer for a major local manufacturing company. For one and a half years after that she worked as a junior consultant for BIS Information Systems NI. She was trained in UNIX and C. Three years ago she joined Nynex Media Communications as a technical programmer using C and C++. Michaela has extensive experience of the FREEVISION Video Business Meeting System Server Software, which includes software for managing Video Switches.

3. OVERALL SYSTEM SPECIFICATION

As outlined in previous documentation the purpose of the entire CCC video delivery system is to integrate remote access to centralized computing resources and enable TV Delivery /Video Meeting.

The overall system configuration incorporates many of CCC's current Video delivery systems as well as building on the existing technologies to provide custom built remote access capabilities.

3.1. High Resolution Switch

The remote access switch will allow . developers within RedWest Building E access to up to 720 servers running various applications still under development. The remote access capability provided by the switch will remove the need for each user to have processing power on the desktop by providing connectivity to the server by means of a simple RJ45 connection.

Each desktop will have access to the centralized resources by means of an authentication process and a server selection process by accessing an application on a small number of "Helper PCs". The switch control server will monitor all desktops, servers and Helper PCs and record all login attempts, connections and resource usage.

The servers (Compaq Proliant 4500 / 5000) will be housed in 19" Compaq racks and will be located on the ground floor within the Manga Lab. The 286 populated racks are organized in suites of between 11 and 14 racks. As well as providing connectivity to the servers stored within these racks from the Manga Client Center and user cubes we also aim to provide a limited supply of access stations within the Manga lab itself. The exact positioning of these stations has not yet been agreed but may be located at diagonally opposite ends of each suite of racks. These stations will be provided as a mechanism capable of coping with any overflow from the Manga Client Center.

Each server will be connected to a FreeDesk transmit card enabling the transmission of keyboard, mouse and RGB signals over a single RJ45. Following investigations into feasible mounting options for multiple FreeDesk cards we have designed a 1U high enclosure containing 4 FreeDesk transmit cards. This unit will be powered by a single power supply which will be housed between adjacent cabinets. If a cabinet has insufficient space available to allow front mounting of these enclosures they can also be fitted vertically between cabinets.

All cabling to connect the servers to the switch will be provided by ComGroup. This will be covered in Section 6.2.

Each desktop will have a minimum of 1 monitor per keyboard with the client software designed to allow connectivity between several monitors and just one keyboard and mouse.

3.2. *Video Meeting System*

The initial proposal has specified the provision of all 290 desktops with the ability to access the Video Meeting and TV delivery switches. However, the proposal also specifies that only 50 of these stations will have the initial hardware (i.e. camera and speakers) to allow Video Meeting sessions and TV delivery to take place.

We understand that at least 2 of these positions will be multi-user positions (e.g. War Room and LCC). As part of these room-based systems we will specify required audio and video systems to provide superior quality conferencing and TV delivery based on detailed discussions with appropriate I / ComGroup personnel.

A detailed questionnaire must be filled out by the client in conjunction with the Project Manager prior to installation.

3.3. *Video Wall*

Current equirements for multiple display walls are as follows:

1) 40 screen wall in LCC (8 W x 5 H).
2) 4 screen wall in War Room (2 W x 2 H)
3) 2 screen wall in Head End Center (2 W x 1 H)

Requirements for these walls and their capabilities will be covered in Section 6.3.

4. HARDWARE SPECIFICATION

4.1. Overview

This document describes in outline form the proposed hardware and interfaces for the high capacity FreeDesk video switch. The switch allows a large number of PC servers to be routed to desktops which have only monitors, keyboards and mice. The system design is modular to allow the numbers of users and servers to be easily increased. Throughout this document, various terms are used to describe inputs and outputs as follows:

- **Server** - PC which is connected to the FreeDesk switch using a FreeDesk transmit interface and available as a resource to users.
- **User** - A desktop position comprised of keyboard, monitor and mouse
- **FreeDesk switch control server (FSC)** - the machine used to control and co-ordinate operation of the high capacity FreeDesk switch

In addition, a number of abbreviations are used to describe signal types as follows:

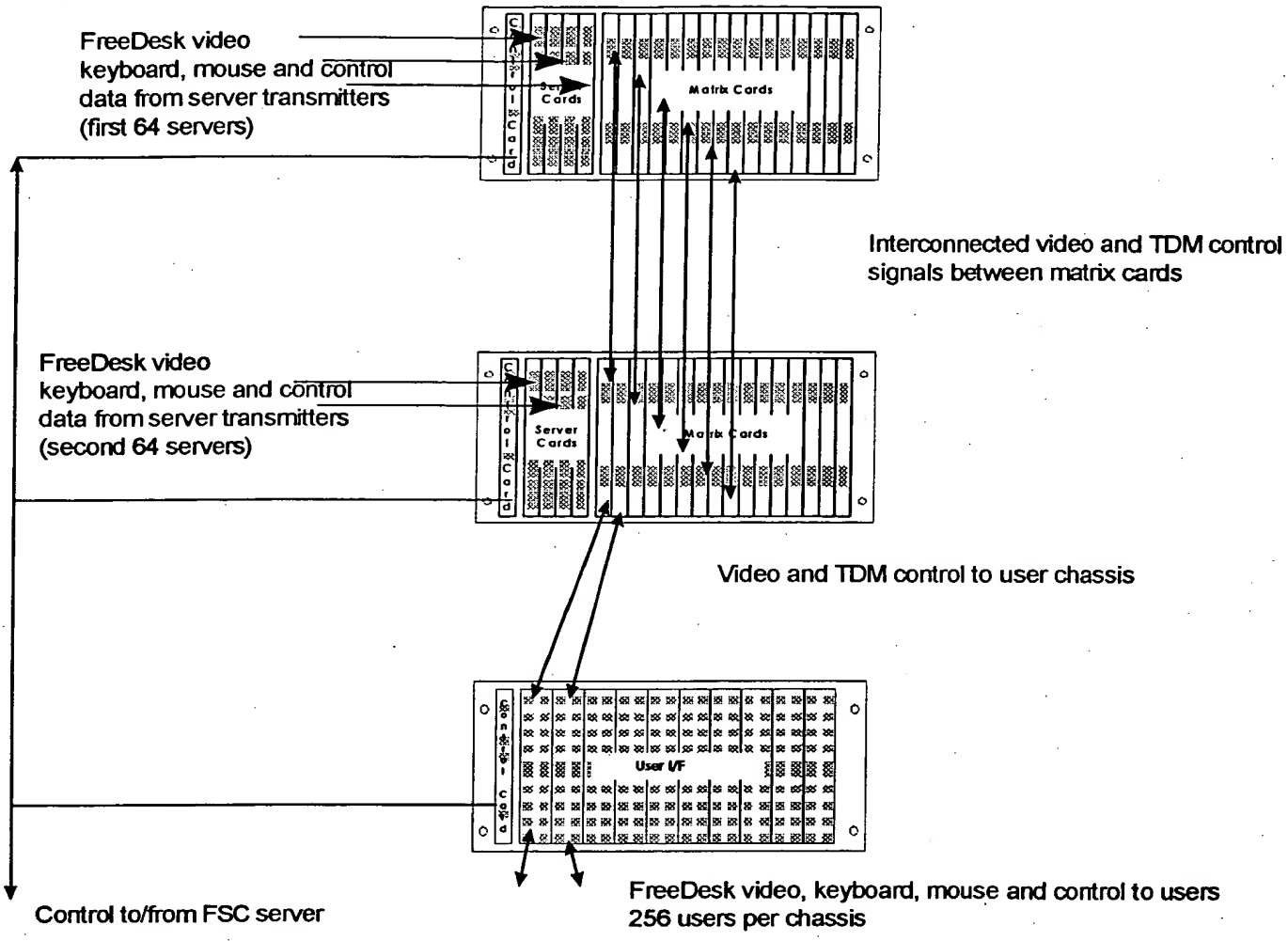
- SVI - Server Video Input, video from servers presented on backplane of switch
- UVO - User Video Output, video output to user desktops
- SBV - Switched Buffered Video, buffered video from backplane on matrix cards
- SBVI - Switched Buffered Video Input, video from previous matrix cards
- SBVO - Switched buffered Video Output, video out to next matrix card or user chassis
- TDM - bi-directional time division multiplexed keyboard and mouse data

A FreeDesk switching system consists of a number of main chassis components

- A number of server interface and matrix chassis - these provide connections to the servers and allow control by the FSC server
- A number of user interface chassis - these provide the final connections to the user desktops
- A suitable number of power supply chassis

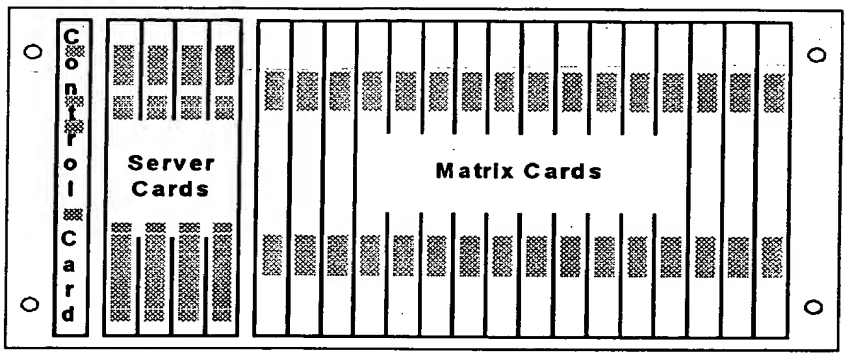
Each server and matrix chassis allows up to 64 servers to be connected to up to 512 users. The system is expanded by extending the matrix with interconnect cables and further chassis.

An outline diagram of overall system connectivity and components is shown overleaf. To preserve clarity, a minimum interconnected system of two server and matrix chassis with one user interface chassis is shown.


FreeDesk video
keyboard, mouse and control
data from server transmitters
(first 64 servers)
Server Cards
Matrix Cards
Interconnected video and TDM control
signals between matrix cards
FreeDesk video
keyboard, mouse and control
data from server transmitters
(second 64 servers)
Server Cards
Matrix Cards
Video and TDM control to user chassis
User I/F
Control to/from FSC server
FreeDesk video, keyboard, mouse and control to users
256 users per chassis

4.2. *Server Interface and Matrix Chassis*

The Server/Matrix Chassis (SMC) holds the cards that interface to the servers and perform the switching. The chassis interfaces to up to 64 servers via 4 server interface cards. The matrix cards provide the switching function (of both video and keyboard/mouse) allowing up to 512 users (via 16 matrix cards) to select any of the 64 servers. The controller card provides the interface to allow the FSC server to set up the switching matrix.



The server matrix chassis (SMC) is a standard 9U high 19" chassis providing up to 21 card positions on a high quality multiwire backplane, each containing one of three card types:

- Server interface - card which provides connectivity for 16 servers
- Switch Card - provides connectivity for up to 32 users
- Controller card - required for control of other cards and interface to FSC server

These various components are described below:

4.3. SMC Backplane

21 slots are available on the backplane, partitioned as follows:

Slot number	Card type
1	Controller
2-5	Server interface
6-21	Switch Cards

Backplane signals are as follows:

- 64x3 (RGB) lines of video - Terminated
- Address/data/control - Terminated
- TDM Serial lines - Terminated
- Interrupts - One Per Server card
  - One for all the switch cards
- Slot address pins - To identify card position.
- Power

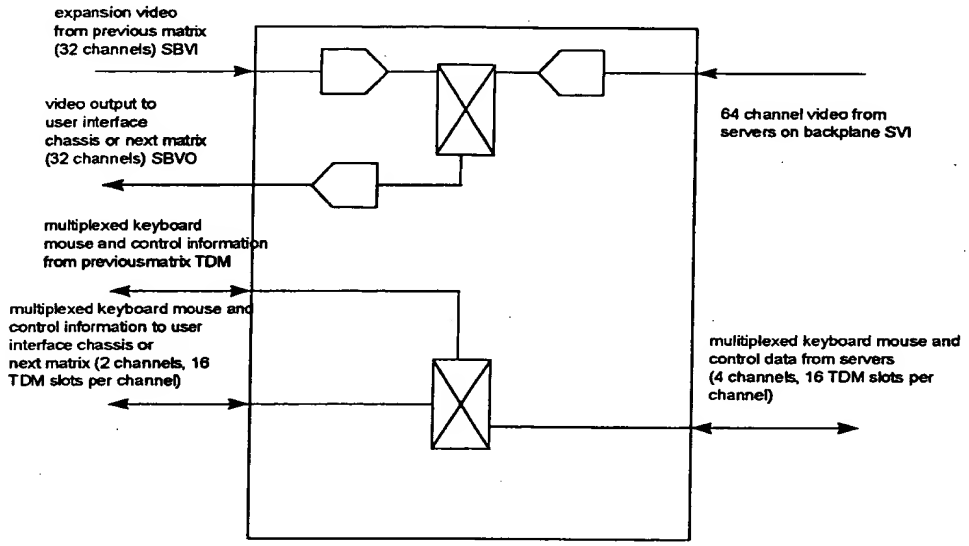
4.4. SMC Matrix Card

The matrix card supports 32 users. It allows any of the users to select either any of the server videos available in the SMC chassis (buffered via the server card) or the user input from the previous SMC. The matrix card also provides routing of the keyboard and mouse from the users to the servers, and routing of the control functions (serial from the servers to the users). It is possible for a user to have the mouse and keyboard routed to different servers.

The card provides the following features :-

- Buffer of 64 backplane videos
- Differential Input of 32 SBVI
- Differential output of 32 SVBO
- Selection of any of the 64 SVI or the SBVI
- Mouse and keyboard crosspoint multiplex switch.
- Front panel connections for video SBVI, SBVO.
- Status LED display

Matrix card block diagram is as follows:



The connectors are arranged so that the extension inputs come from the top of the card and the outputs at the bottom of the card.

4.5. Server Interface card

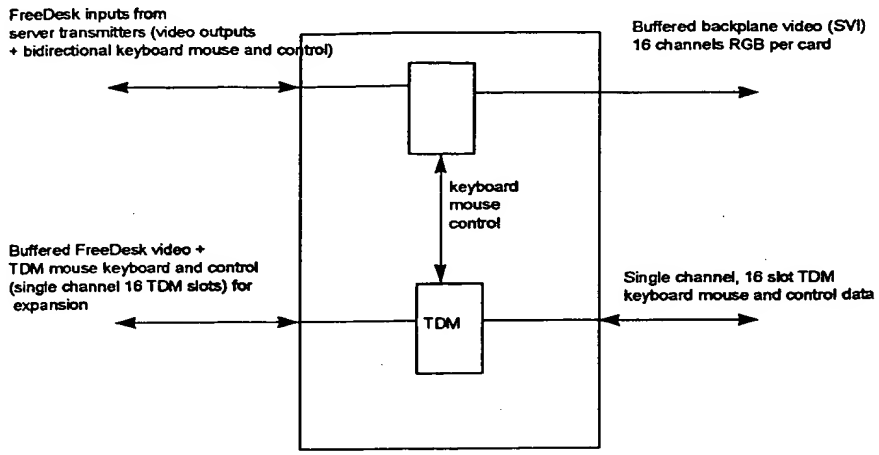
The server interface card provides connectivity from FreeDesk transmitters located close to the servers. Each card provides 16 RJ45 connectors, one for each server, configured as follows:

1	Red video - HS , 2 volts p-p
2	Red video + HS , 2 volts p-p
3	Current serial multiplex send
4	Green video - CS, 2 volts p-p
5	Green video + CS, 2 volts p-p
6	Current serial multiplex receive
7	Blue video - composite polarity, 2 volts p-p
8	Blue video + composite polarity, 2 volts p-p

In addition, the server interface card provides :-

- 16 FreeDesk receivers per card.
- Drive of 16 video lines onto backplane using tri-state devices.
- Demultiplexing of mouse and keyboard TDM for transmission of mouse and keyboard to server.
- Multiplexing of serial control information onto TDM line for distribution to the matrix cards.
- Receipt of clock and frame pulse from controller for serial multiplexing/demultiplexing.
- Status LED's for each FreeDesk.
- Buffer of 16 video lines for expansion and serial TDM lines for expansion.
- The FreeDesk keyboard and mouse operation will be modified to appear active at all times so that servers can boot, without a keyboard being present

The server card block diagram is shown below:



4.6. *SMC Controller Card*

The Controller card interfaces between the external FSC server and the server interface cards and the matrix cards, and provides overall control of the switching chassis

The card has its own processor which is used to decode commands from the FSC server and build command strings to pass to the server interface and matrix cards, and to concentrate keyboard and mouse signaling for return to the FSC server. The card also maintains a non-volatile switch map so that individual cards may be hot-swapped and the status restored after power out.

The controller card provides :

- 80x86 CPU
- Local memory to maintain local switch table.
- Dual serial I/F - High speed serial links to host RS422.
  - Diagnostic connection RS232.
- Flash memory for program, downloaded via serial interface.
- ID switches for chassis and user.
- Status LED's - OK, serial OK, received command, reset.

4.7. *Embedded SMC Controller Firmware*

The control card provides a very simple command based interface for controlling the matrix switch, similar to other C-C-C products. The firmware for this card may be downloaded from the host, providing field upgradeability. This interface will normally be under the control of the FSC server, but could be used standalone at a terminal session. The commands provide functionality to patch video inputs to outputs, and to patch keyboard and mouse signaling channels, using two commands, firstly

patch video x y

where x is the identification number of the server (actually the port number on the switch the server is connected to), and y is the user identification number (again, the port number). This command allows any server to feed any user. In fact, the command allows multiple users to connect to one server (but not vice versa).

secondly,

patch control x y

where x and y have the same meanings.

The control card will issue an **FD:** prompt before these commands. Since this command structure is an extension of normal FreeVision products, the commands may be abbreviated to the minimum required for uniqueness (p v 1 7 for example).

The switch commands are broadcast to all controller cards. The controllers then decode the switch instructions, the server id number is compared with the range of available server ids in the switch and the user id used to select the correct user slot.

If a server is enabled its video is buffered onto the backplane by the server interface card. If a server is disabled its video is disabled from the backplane to save power and noise.

If a server id is less than the minimum server id for that switch then the video matrix for that user is disabled and the SBV tri-stated.

If the server id is greater than the maximum server id for that switch then the matrix for that user is disabled, but the SBV is enabled.

If the server id is within range for that switch then the matrix and SVBO are enabled.

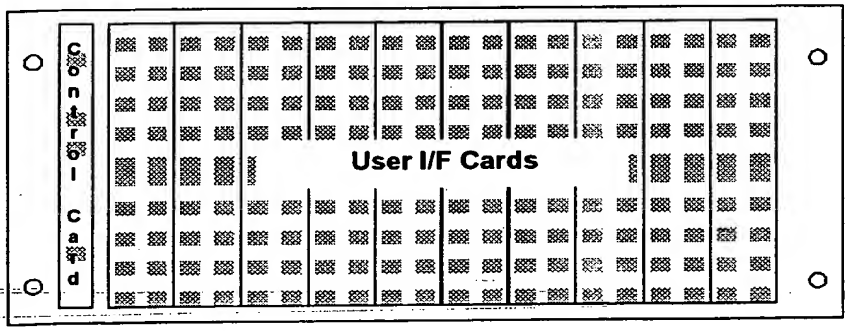
On reset all switch cards set to buffered through mode (SBVI to SBVO).

4.8. *User Interface Chassis*

The user interface chassis receives switched RGB video and switched mouse and keyboard signaling. It then buffers these out to the FreeDesk transmitters on each user interface card for onward transmission to the desktop, via 16 RJ45 connectors, each connector configured as follows:

1	Red video - HS , 2 volts p-p
2	Red video + HS , 2 volts p-p
3	Current serial multiplex send
4	Green video - CS, 2 volts p-p
5	Green video + CS, 2 volts p-p
6	Current serial multiplex receive
7	Blue video - composite polarity, 2 volts p-p
8	Blue video + composite polarity, 2 volts p-p

The FreeDesk received keyboard and mouse data from the desktop is multiplexed onto a single line for transmission to the SMC chassis.



The user interface chassis is a standard 9U high 19" chassis providing up to 21 card positions on a high quality multiwire backplane, each containing one of two card types:

- User interface - 16 user Interface card.
- Controller card - Control and FSC server I/F

4.9. UIC Backplane

21 slots are available on the backplane, partitioned as follows:

Slot number	Card type
1	Controller
2-21	User interface cards

The backplane provides the following :-

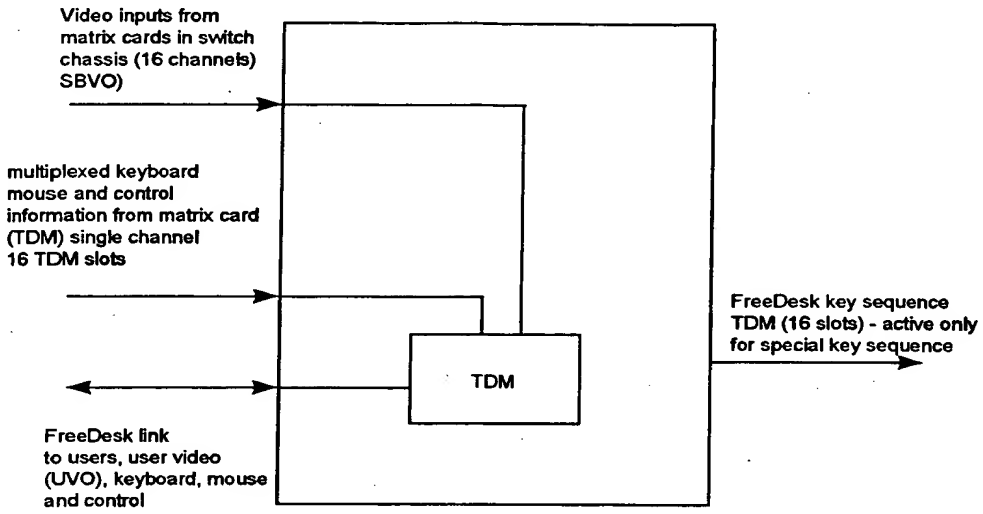
- Address/data/control - Terminated
- TDM Serial lines - Terminated
- Interrupts - One for all user interface
- Hard-coded slot addresses - To identify card position.
- Power

4.10. User Interface Card

The User interface card provides :

- Individual FreeDesk transmitters per user.
- Mouse and keyboard information received from the user via FreeDesk is multiplexed onto the TDM line for transmission into the switch.
- Control information is demultiplexed from the TDM line and transmitted via FreeDesk to the user.
- Special key sequence is trapped for each user and transmitted using TDM to control card for onward transmission to FSC server
- Status LED display
- Re-align RGB using sync position.
- Adjust gain of RGB using sync size.

A block diagram of the user interface card is shown below:



4.11. UIC Controller Card

This card has the same hardware configuration as the SMC controller card. The main purpose of this controller card is to extract information from the keyboard and mouse multiplex to alert the FSC server that a user has issued the attention sequence (normally by pressing Alt-Break). The controller card then formats this information together with a number of subsequent keystrokes and passes them to the FSC server via the RS422 port.

4.12. Embedded UIC Controller Firmware

The PIC controller on the FreeDesk user interface card will extract the Alt-Break key sequence and pass this and the next characters (a system programmable number) to the control TDM serial line. The controller card will then decode these characters and add the user ID before passing the characters to the FSC server. The protocol for these commands is as follows:

Byte 0: Start of message
Byte 1: User id MSB
Byte 2: User id LSB
Byte 3: Key scan code

4.13. Desktop Interface

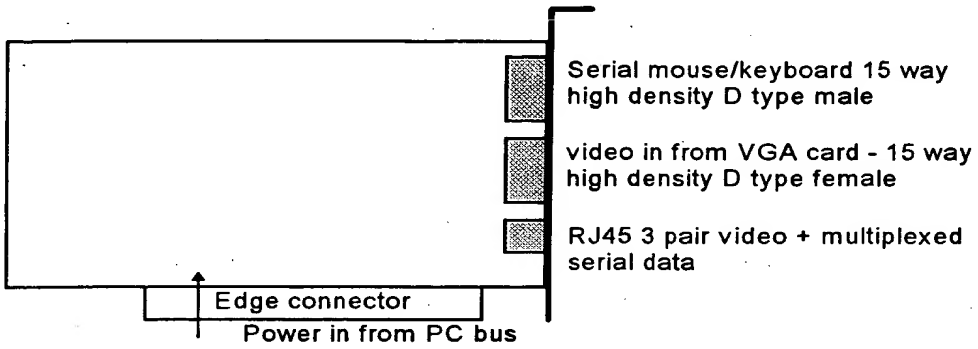
The desktop interface is a modified C-C-C DTV unit, which combines the functions of the current DTV unit (video overlay and conferencing) with a FreeDesk receiver. This eliminates a number of interconnections and provides a single desktop unit which can service all desktop requirements. The unit provides the following connections:

- Input from FreeDesk transmitter (i.e. the output of the user interface chassis) on a single RJ45
- Input from FreeBand or FreeBand/FreeComms combined on a single RJ45
- Output to monitor in VGA format
- Input from auxiliary audio and video
- Output to auxiliary audio and video
- Input from keyboard (PS2 style connector)
- Input from mouse (9 way D serial)

4.14. Server Transmit Interface

Each server will require a FreeDesk transmit interface to provide the correct presentation for patching into the high capacity switch. This is normally available as an ISA based card, for mounting within the server chassis itself, as described below

The transmitter takes the output from the VGA card in the PC, together with the keyboard and mouse connections, and transmits these down a single four pair RJ45 connection. Connections to the PC are made using front panel connectors, the ISA bus is used only for power, the card does not use any system resources such as interrupts and address space.



Video from the VGA card in the PC is presented to the transmit card using a short VGA-VGA cable (FD-001). Standard VGA has three color signals of 0.7V peak to peak, and separate horizontal and vertical sync signals at TTL levels. VGA sync signal polarities also differ dependent on screen resolution (i.e. they may be negative going pulses from a norm of a positive level or positive going pulses from a norm of ground). FreeDesk detects the sync polarity and inverts it if required (it must be negative going to produce a correct composite sync signal), before combining the syncs with the green color information (sync on green). The horizontal sync signal is also combined with the red signal, and the blue signal carries information about the polarity of the input syncs. These three signals are then passed through differential drivers to drive the twisted pair.

Keyboard and mouse information is presented to the transmit card using a special cable (FD-002) which connects the keyboard (min DIN), PS2 mouse (mini DIN) and serial mouse (9 way D) to a 15 way high density D connector. These signals are passed internally to a microprocessor which combines them together in a single data stream for transmission to the FreeDesk receiver down a single pair. This is then transmitted using a bi-directional opto isolated current loop to the receiver at the desktop. The serial data protocol is half duplex and places data in addressed packets. Packets consist of 10 bits, 8 for data and 2 for address. This allows four packet types, keyboard, serial mouse, PS2 mouse and control. The control packet type is used for system housekeeping and synchronization.

4.15. Custom MSN FreeDesk

To make such a large installation more convenient, FreeDesk will be repackaged to provide the functionality of four FreeDesk interfaces (described above) in one 1U high chassis. This may be mounted in the rack itself, or possibly in the space between cabinets.

4.16. Power supplies

The power supplies for the high capacity FreeDesk are designed to provide significant power with very low noise. To provide a robust environment for mission critical applications, each power supply contains two separate power supplies which normally share the load. In the event of one of the power supplies failing, the other is able to fully provide the load, whilst the other is replaced. To provide low noise power they use a linear design, specification as follows.

4.16.1. AC Input

208-230 VAC 47-63Hz 6A

- Input via standard IEC connector (EN 60 320)

4.16.2. DC Output

+/- 5V @ 60A (power supply 1)
+/- 5V @ 60A (power supply 2)

- Power supplies internally OR'd via Schottky sharing diodes

- Power supplied via suitable stud connectors
- Remote sense inputs using ¼" spade connectors
- Overvoltage and short circuit protection on all outputs

4.16.3.Status outputs

open-collector TTL Power Good logic signal pulled low when all of the supply rails are good, available via ¼" spade connectors

Power Good = < 0.8V @ 4mA (active sink)
Power Bad = < 0.1mA @ 5.5V (inactive withstand)

4.16.4.Load regulation

+/- 0.1% for 10% load change

4.16.5.Output ripple

5mV p-p maximum

4.16.6.Mechanical

- 3U high, 19" chassis, fully enclosed and screened, contains two hot swappable power modules, each able to supply full load

- Temperature controlled forced air cooling by internal fans - fans are activated if temperature exceeds design rating
- LED indication of power input, power good/bad and overcurrent/overvoltage on front panel

5. SOFTWARE SPECIFICATION

Software Description of Project

The document below offers a high-level overview of the software controlling the Switch. There are basically three applications which need to be written and these will be broken down into their various components at the end of the document. The description below is based on the current understanding of how the users wish to work and is open to refinement if any of the assumptions are inaccurate.

The Scenario
The basic scenario is that of a user who can sit down at a particular station and can then access a number of servers from an allowable pool of servers which has been allocated to that user or a particular work-group to which they belong. It is assumed that the user simply has access to a mouse, keyboard and one or more monitors at his desk. By pressing a series of keys they can perform the following actions:

- Authenticate themselves on the local NT domain
- Set up at the start which servers the client would like access to
- Set up which servers they can have read-only access to
- Choose which monitors on their desk they would like to assign servers to
- Toggle between the control of various servers by a simple key-press

5.1. The Server Application

This maintains the list of servers and users. The application would be written for NT and would obtain access privileges from information written to a database (such as MS SQL Server) by the administration module. The server software will run on a Compaq Rack-Mount 5000 server running the Windows NT 4.0 Server product. The Server will be setup as an NT Backup Domain Server, so that all the Domain information for connected users is contained on the Switch Server, through replication.

The Server will be resident in a rack beside the C-C-C switching hardware, and will provide all capabilities to seamlessly connect a remote keyboard/mouse/ vga to a chosen server located in the Communications room depending on the user access levels.

The Server software will be written using C++ with the Windows front-end written using Visual C++. The code will be designed in a modular fashion to allow easy customization when required by the client.

The Server will constantly monitor the high speed serial connection between it and the Keyboard / Mouse Multiplexor, for a key-press.

When a key is pressed from an unconnected remote keyboard / mouse the Server uses the unit number provided, and performs the following actions :-

IF THE UNIT HAS NOT PREVIOUSLY BEEN LOGGED ON, THAT DAY
(i) Check the status of the Helper PC's.
(ii) When a free Helper PC is found send a command to run the login validation software on the Helper PC, then a Switch command to switch the unit to this Helper PC.

IF THE UNIT HAS ALREADY LOGGED ON, THAT DAY
(i) Check the status of the Helper PC's.
(ii) When a free Helper PC is found send a command to run the switch selection software with the appropriate user information on the Helper PC then a Switch command to switch the unit to this Helper PC.

Once the Helper PC has validated the user it displays a selection of servers to which the user can connect. The access rights are configured on the Server Administration Software (either by group or individual). A Switch command is then sent to the hardware to switch the unit to the chosen Server.

The Server will send a Switch command to the hardware to switch the connection from the Server off and switch back to a Helper PC as above.

If a session is inactive for 30 minutes the Server will send a command to switch the connection to the Server off and switch back to a Helper PC.

5.2. Server Administration Application

This module is concerned with the administration functionality of the CCC Switch Server in order to maintain the users and the access to particular servers. It is envisioned that the maintenance module would obtain a list of users and domains from the local NT domain server and present them as a list of selectable users and also read a file which contains the ID's of the available servers.
This module needs further definition by the client but an initial system may require the following features:

- Link individual users with individual servers
- Link whole workgroups with individual servers
- Assign and name Helper PC's

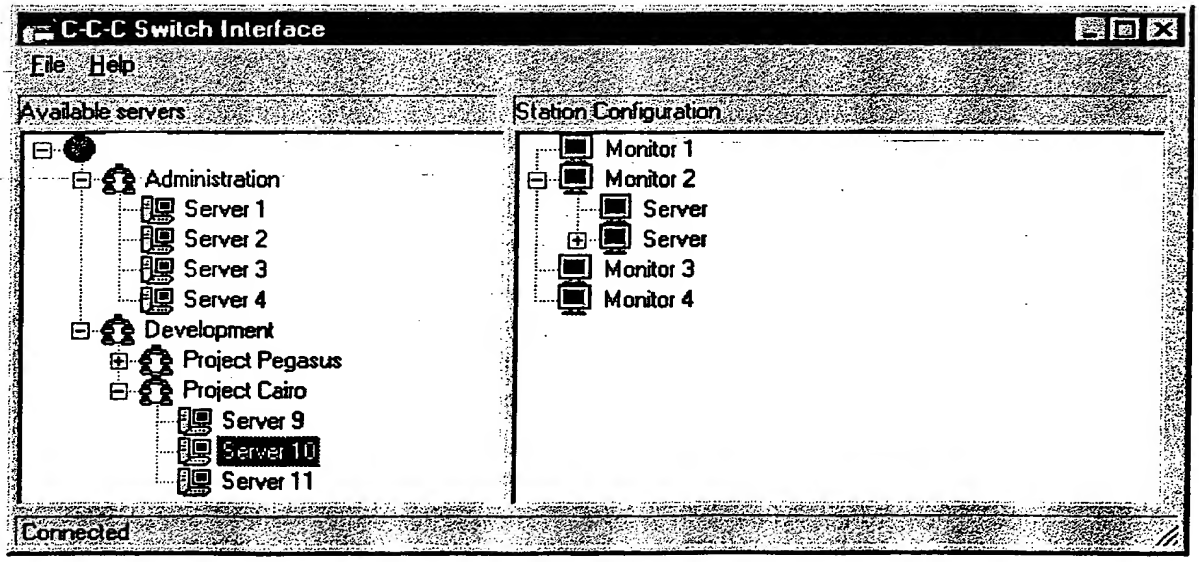
5.3. The Helper PC Application

The Helper PC provides the only means for users to interact with the system. Any actions which require information from the user (such as the LOGIN details) or provide feedback to the user (such as which servers the user has access to) are displayed on the Helper PC screen which is switched to the monitor on the users' desks.

The user would communicate the action they wish to perform by typing certain key sequences on the keyboard at their desk position. Different key sequences would invoke different functions in the Helper PC.

One key sequence would invoke the LOGIN screen on the helper PC which would allow the user to enter username, password and group. The LOGIN screen would be in the style of the NT LOGIN display which would be familiar to users. It should be noted that the Helper PC is already logged in and authenticated on the local NT Domain but it is necessary now for the Helper PC to validate the user on this domain from the information just typed in by the user. This would be done by means of the NT security API. Once the user is validated the Helper PC can request a list of allowable servers from the C-C-C Server and this could then be presented to the user.

The diagram below shows a possible representation of the Server selection screen which could be presented to the user. The Windows95 explorer type interface would allow users to drag-and-drop servers onto the screen positions at the users desk. In the diagram, the user has the choice of displaying the servers on up to four screens. The configuration of which servers can be displayed on which screens is totally under the control of the user. Servers which are already being used could be tagged to indicate that if selected, the user would have read-only access to that server. Once the user is satisfied with the configuration the server could disconnect the user from the Helper PC and connect them to the first server.



At any time it should be possible for the user to press a special key sequence which would allow the re-configuration of server displays or removal of servers to free them up for other users.

Right clicking the mouse button on servers that are currently being used could display the username of the user who is using it if this was desired.

The Helper PC would also be able to at any point indicate to the server whether or not it was currently busy. This way, the server would at all times have a list of available Helper PC's which it could allocate as users requested them.

5.4. SOFTWARE MODULE BREAKDOWN

5.4.1. HELPER PC

The Helper PC's job is to interact with the user in the period prior to connection with a server. It would display both dialog boxes for user input as well as provide feedback screens indicating current status.

NT LOGIN BOX DISPLAY - Displays a Windows NT look-alike login dialog box for the user to type details into. Should include username, password and group identification

AUTHENTICATION MODULE - Uses the information obtained from the 'NT login Box Display' or passed parameters and validates the user on the local NT domain. A suitable message would be displayed if the authentication fails.

AVAILABLE SERVER DISPLAY - Displays a list of the available servers in an 'MS Explorer' style interface. The Window would be split into two with the left hand side displaying a list of the servers which could be connected to. This server list could be tagged to allow the user to see which servers are being used. The right hand side would display the users desktop configuration. The user could drag-and-drop servers onto particular screens on the desk. This would be under the control of the user. Hence if the user has three screens available and has chosen 4 servers he could allocate two servers to be switchable on his main monitor and allocate the other servers for each of the remaining screens.

STATUS MODULE - Responds to requests from the server to indicate whether it is currently busy or free. Would also have functions to force itself into a free state if say the server requested it.

5.4.2. C-C-C SWITCH SERVER

Main NT server responsible for allocating and de-allocating servers to users. This would be a multi-threaded application which would also be required to store the current status of all users and servers in memory for speed reasons. Hence would need quite a high spec machine.

HELPER PC AVAILABILITY MODULE - Polls known Helper PC's and returns the ID of a free one for connection to the user.

STATION/USER/HPC MONITOR - holds a list of the current connections and users logged on. Would include functions to return the immediate status of users or servers. This information could be passed on to the Helper PC when server lists etc. are requested.

SWITCH CONTROLLER - This module would transmit the actual commands to patch the relevant ports together, This could be patching both video and keyboard/mouse or just video for users with read-only capability

KEY-PRESS MONITOR - Monitors FreeDesk actions by users and when a complete command is identified, can take the appropriate action

INITIALIZATION MODULE - Used to extract the information from the SQL server to set up the initial state of the server. This may be required to represent server allocation rights in some internal form for fast access.

TRANSACTION LOGGING
Module to write current connection data to the database and do so while running in the background

REPORTING FUNCTIONS
Returns lists containing information such as 'Who's logged on at present', 'who's using a particular server', ' which servers is Station 1 Connected to' etc. Used mainly for system administrators to obtain a 'snapshot' of the current work in progress.

5.4.3. ADMINISTRATION MODULE

This application would be required to set up and store to the database the particular user allocation rights and restrictions to the servers. Would incorporate a graphical front end to aid in the server administration jobs.

INITIALIZATION - Extracts the current status of server-user allocation from the database.

INTERFACE - Modeled to have the same look-and-feel of the usual NT administration modules

CONFIGURATION FRONT END - Drag -and-drop style interface to allocate users to servers on an individual basis or workgroups to servers. Perhaps could also mark certain servers as read-only for certain users.

HELPER PC POOL - Stores the locations and numbers of the Helper PC's. Could add or remove helper PC's as required

SERVER-USER POOL - Add/Remove Servers or Users from the available resource pool.

BACKUP MODULE - Writes the new status of server-user allocation back to the database

REPORTING FUNCTIONS - Off-Line functions which could print usage statistics.

6. PHYSICAL AND ELECTRICAL REQUIREMENTS

6.1. General Cabling Requirements

Each server will require a single RJ45 CAT 5 connection to the High Res switch.
This connection will be handled by the FreeDesk Transmit card.
Since several servers are mounted within a single cabinet a 1U high enclosure containing up to 4 transmit cards will be developed to mount either horizontally at the front of the cabinet or vertically between adjacent cabinets.

All server connections will be brought back to the switch location in the Manga Cable Room.
Current standard uses 6 x 4 pair cable (CommScope 24 Pair Twisted Pair Cable supplied by Anixter) which we would hope to use depending on an agreed termination policy for both inputs and outputs. The options we have for termination are as follows:

1) use existing 6 port units mountable within vertical cabinet supports :
   This type of termination is currently employed successfully within Comms rooms but is unlikely to be an effective solution where large cable quantities are involved.

2) Due to the high density of cables required for each chassis (64 Cat 5) we could install high density patch-panels be used to provide this connectivity and provide connection to switch by means of short patch cords.
   This method will substantially increase the total space requirements for the switching equipment but would improve cable management and ease installation.

The preferred method is outlined below.

3) The 6 x 4 pair cable could be suitably terminated with RJ45 plugs to allow direct connection to the server cards in the matrix chassis. These cables could be strapped in an efficient manner to provide suitable cable management.

Outputs from the fan-out chassis to the desktop locations will also require a single RJ45 connection and should be presented in the switch cabinet as high density patch panels to provide the added flexibility usually required for the output end of a high capacity installation. Only the last matrix chassis in the array will be connected to this output chassis, which will be located in the last switch cabinet.

All desks requiring access to the Video Meeting / TV delivery switches will require an additional RJ45 connection for A/V purposes. These should be accessible from the Video Meeting Server which will be located in the Head End Center.

Each display screen of the 8x5 FreeWall will also require a Cat 5 cable connecting back to the FreeWall controller located in the Head End Center cable room.

Since all desks will be wired with a standard 6 pack configuration (4 data / 2 voice) this will meet initial C-C-C requirements. For desks with several desktops additional Cat 5 connectivity will be required to provide connectivity back to the High resolution Switch cabinets. A detailed site survey should be conducted as soon as possible to define exact desk-by-desk requirements and incorporate these cabling requirements into Phase I cable installations.

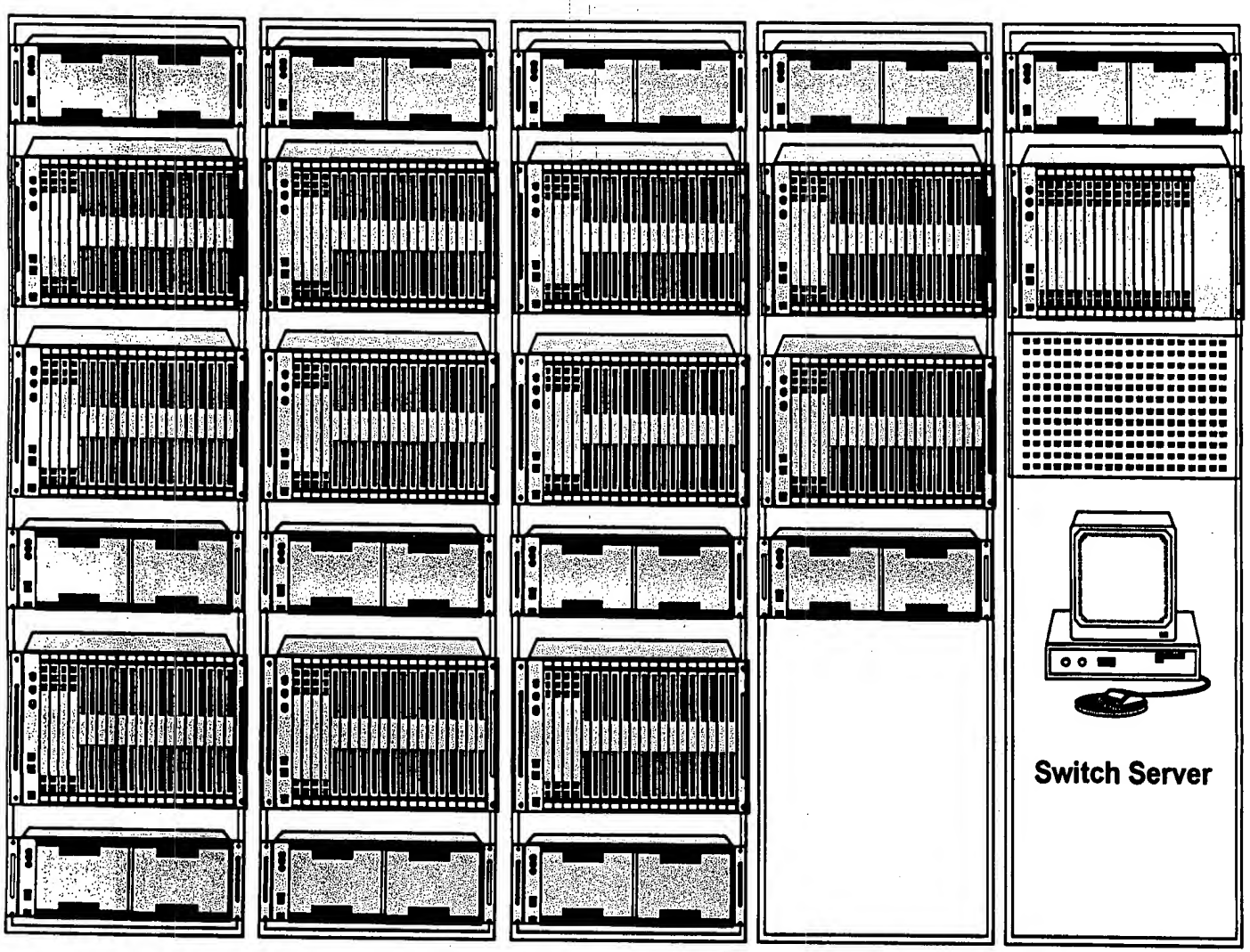
6.2. *Video Switch Requirements*

The interconnect strategy between each chassis is one of minimum required cable length so it is not currently feasible to split the switch across several locations within the Manga Cable Room. Our system has no special cooling requirements above and beyond that provided within the Manga Cable Room / Critical Cable Room. We do suggest that extractor fans are mounted in the roof of the cabinets to pull the cooled air flowing beneath the raised floor up through the cabinets.
All 11 chassis will be chained together as shown below and will have linear power supplies mounted as required.
Each matrix chassis will require a maximum of 1.2 kW provided by means of hard-wired UL approved power supply chassis containing 2 power supplies and measuring 3U high. Whilst the connection to the matrix chassis will be connected directly to the switch backplane we can provide any specified connector to handle the 208V/4A supply into the PSU chassis.
See Section 4.16 for detailed power discussion.

Since UPS can be provided to any location the need to place the switch within the Critical Cable Room is not of paramount importance. However, the entire system must be live to provide connectivity of all servers, so therefore we require that all cabinets for the switching equipment must be powered by UPS.

At the desktop we require a combined video overlay and FreeDesk receive unit which will connect to the desktop devices by standard supplied cabling.

The diagrammatic representation below illustrates the desired cabinet layout for the video switch chassis and associated hardware.



NOTES

PowerSupply

Matrix Chassis

C-C-C
(USA) INC

1227 OLD WALT
WHITMAN ROAD
MELVILLE
NY 11747

TEL:- 516-547-8888
FAX:- 516-547-5566

TITLE:
High Res
Cabinet
Requirements

DRG. No: -CAB-01
ISSUE:C DATE:
NOT TO SCALE

6.3. Video Wall Requirements

Three separate wall installations are included in the initial proposal.
Detailed surveys for all three locations will be carried out prior to installation to determine exact requirements.
We will need to determine which feeds are required for display onto the walls and the exact configuration of the matrices themselves. The FreeWall Manager software is used in conjunction with the FreeWall Controller board The interface is extremely easy to navigate as it is designed to fully replicate the FreeWall itself so that "What You See Is What You Get". The interface is intuitive to the user and the majority of its functions can be activated by one simple click on a button.
Currently, control of each FreeWall is achieved by a single standalone station which could be integrated into the wall surround or on a desktop occupied by a shift supervisor.

6.3.1. LCC

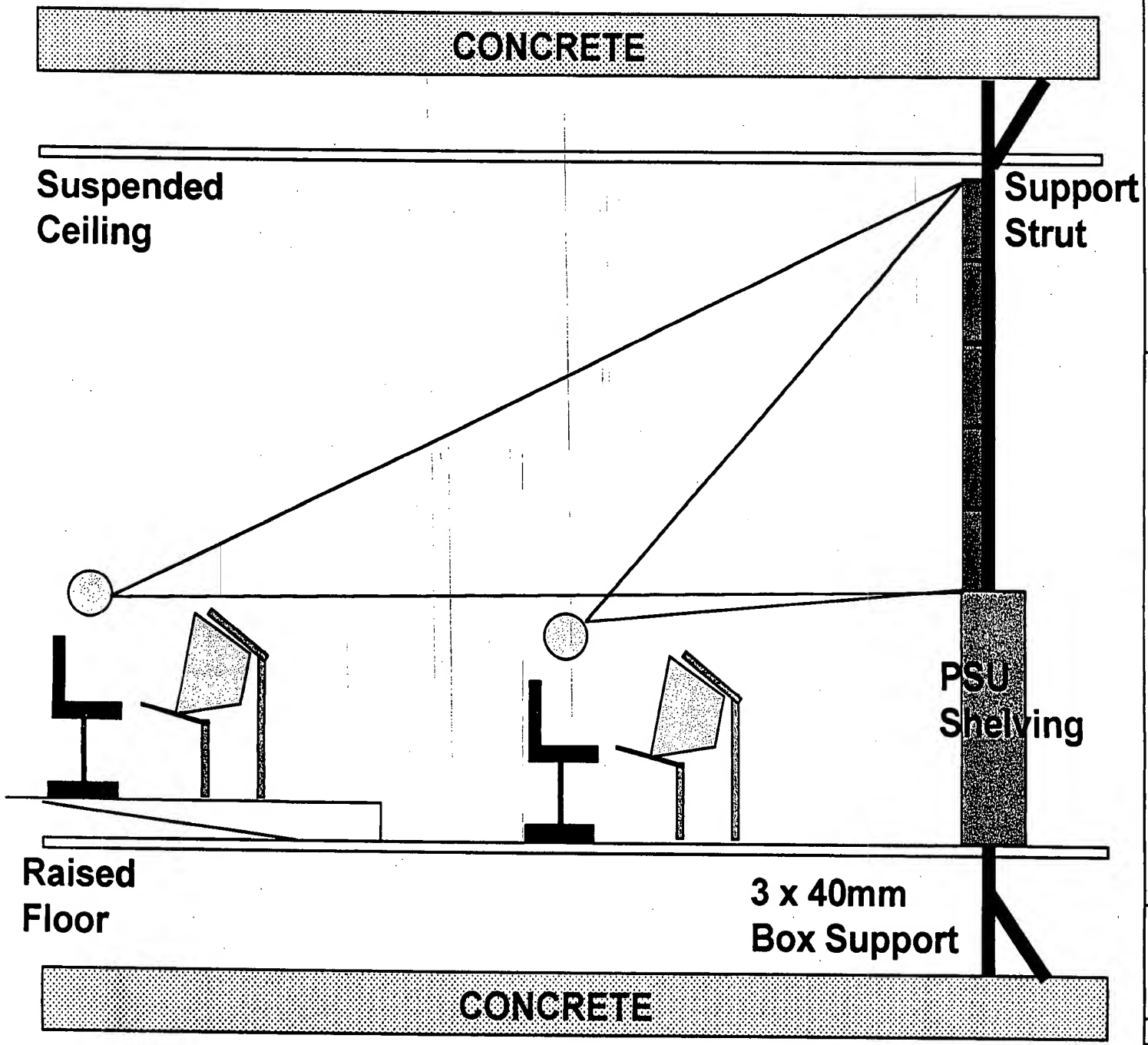
The 8 x 5 video wall to be installed in the LCC will initially be controlled by a single controller and providing scaling through only one scaling controller. This implies that only 1 scaleable image can be displayed at one time with all remaining images to be displayed on individual screens within the overall wall matrix.

Development of a scaling controller to handle multiple scaleable images is underway but will only be completed after all of the requirements for the high resolution switch have been met. Delivery of a controller to handle multiple-scaleable images will also require the development of an appropriately capable software administration tool which, timescales for which are included in the project plan.

Cabinet requirements detailed above have been calculated with the expansion necessary to cope with any additional hardware required to achieve final requirements.

The LCC wall will also have the capability of displaying a Video Meeting session and to enable this a high magnification camera (complete with view presets) will be incorporated into the room layout. Recommendations for positioning of this camera as well as a suitable audio system will be provided following discussions with architects and input from ComGroup.

This document includes drawings to demonstrate current mounting strategy and specifications on the entire wall itself. Initial discussions had indicated that the 8 x 5 wall could be tilted at an angle. Ongoing discussions with the supplier of the metal framework have indicated that a tilted display would require a substantial structure to cope with the large forces exerted by the weight of the 40 screens. With this advice in mind we suggest that the wall be mounted vertically with vertical supports from top to bottom along the length of the metalwork lattice providing sufficient load-bearing capability. These three support struts could be bolted to the concrete floor and roof beams to ensure sufficient stability. However, should this angled requirement prove to be a necessity we suggest in-depth discussions between appropriate architectural and engineering staff in Seattle and our Metal Design engineers in London to achieve the desired solution.



NOTES

C-C-C
(USA) INC

1227 OLD WALT
WHITMAN ROAD
MELVILLE
NY 11747

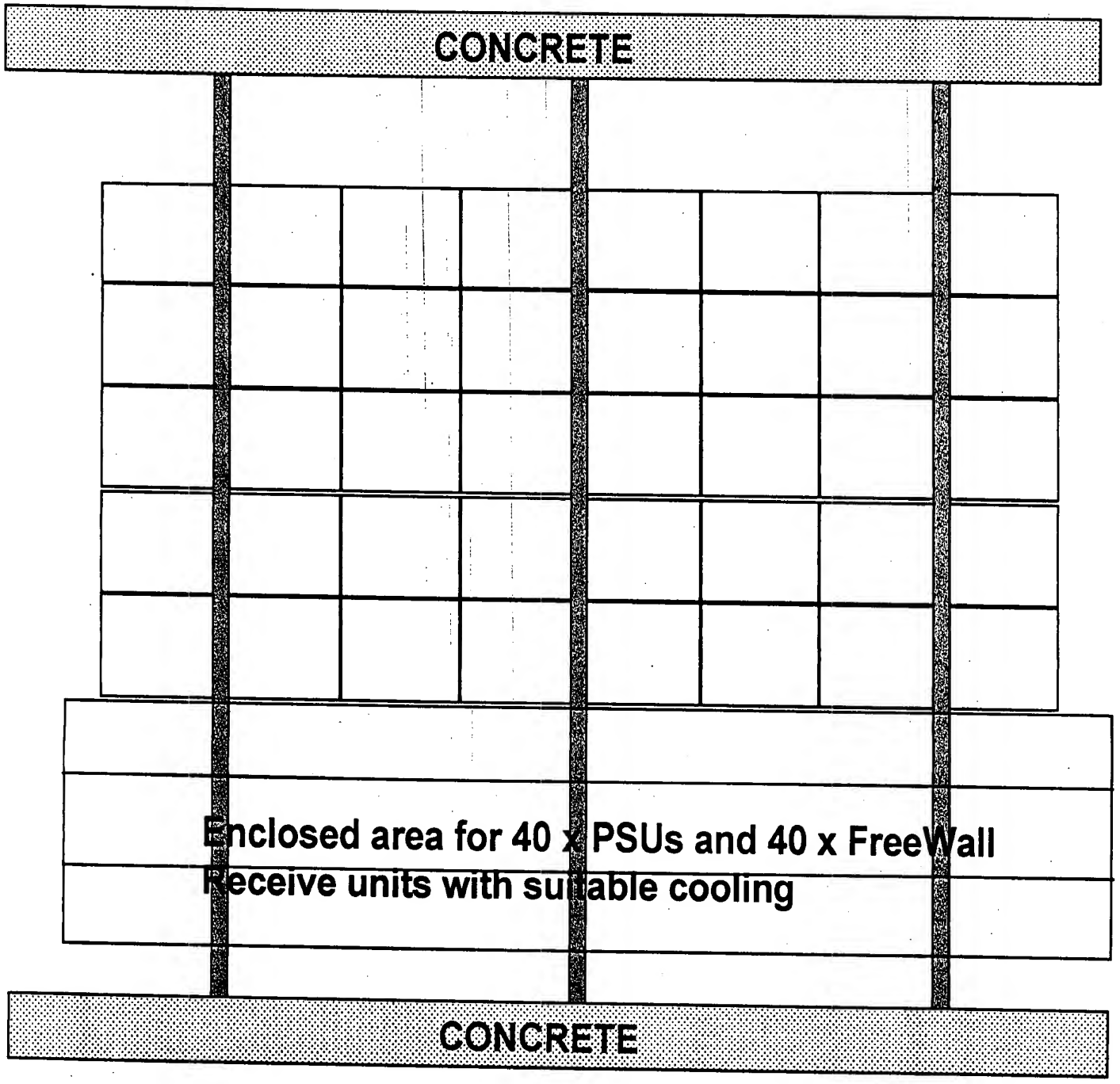
TEL:- 516-547-8888
FAX:- 516-547-5566

TITLE:
.CC 8 x 5
VIDEO WALL
CONFIG

DRG. No: LCC-01

ISSUE: DATE:

NOT TO SCALE



NOTES

C-C-C
(USA) INC

1227 OLD WALT
WHITMAN ROAD
MELVILLE
NY 11747

TEL:- 516-547-8888
FAX:- 516-547-5566

TITLE:
.CC 8 x 5
VIDEO WALL
REAR VIEW

DRG. No: LCC-02
ISSUE: DATE:
NOT TO SCALE

6.3.2. War Room Requirements

The War Room provides a 2 x 2 wall accepting multiple inputs and will be used for video meetings and to browse relevant information during infrequent crisis meetings. A single control station will provide administration for the video conferencing application.
This control station can be built into the wall surround if required.

A standard 2 x 2 metalwork lattice will be used to mount the Fujitsu screens. As with the LCC this lattice will be supported by vertical load bearing struts.

Existing small installations allow for mounting of individual screen power supply units to be mounted within the frame at the rear of the displays. For the 2 x 2 wall here, this option is feasible as is the alternative option of positioning all PSUs in a suitably cooled enclosure adjacent to the wall.

No wall controller has been included for this wall. All feeds to the individual displays must be connected manually. These screens could be attached to the video switch to display server applications.

6.3.3. Head End Center

The Head End Center takes feeds from various locations and provides a centralized administration facility. The 2 x 1 wall will provide direct access to the head end for a variety of functions and can be mounted using custom made mountings, as before, or with Fujitsu standard mounting brackets.

We suggest that the application of this wall be investigated further to decide whether or not the use of a wall controller is suitable. With installations of this size it is unusual to provide flexibility which is unlikely to be utilized.

6.3.4. Specifications for Fujitsu 21" Color Plasma Display Monitors

PDS 2170 Series

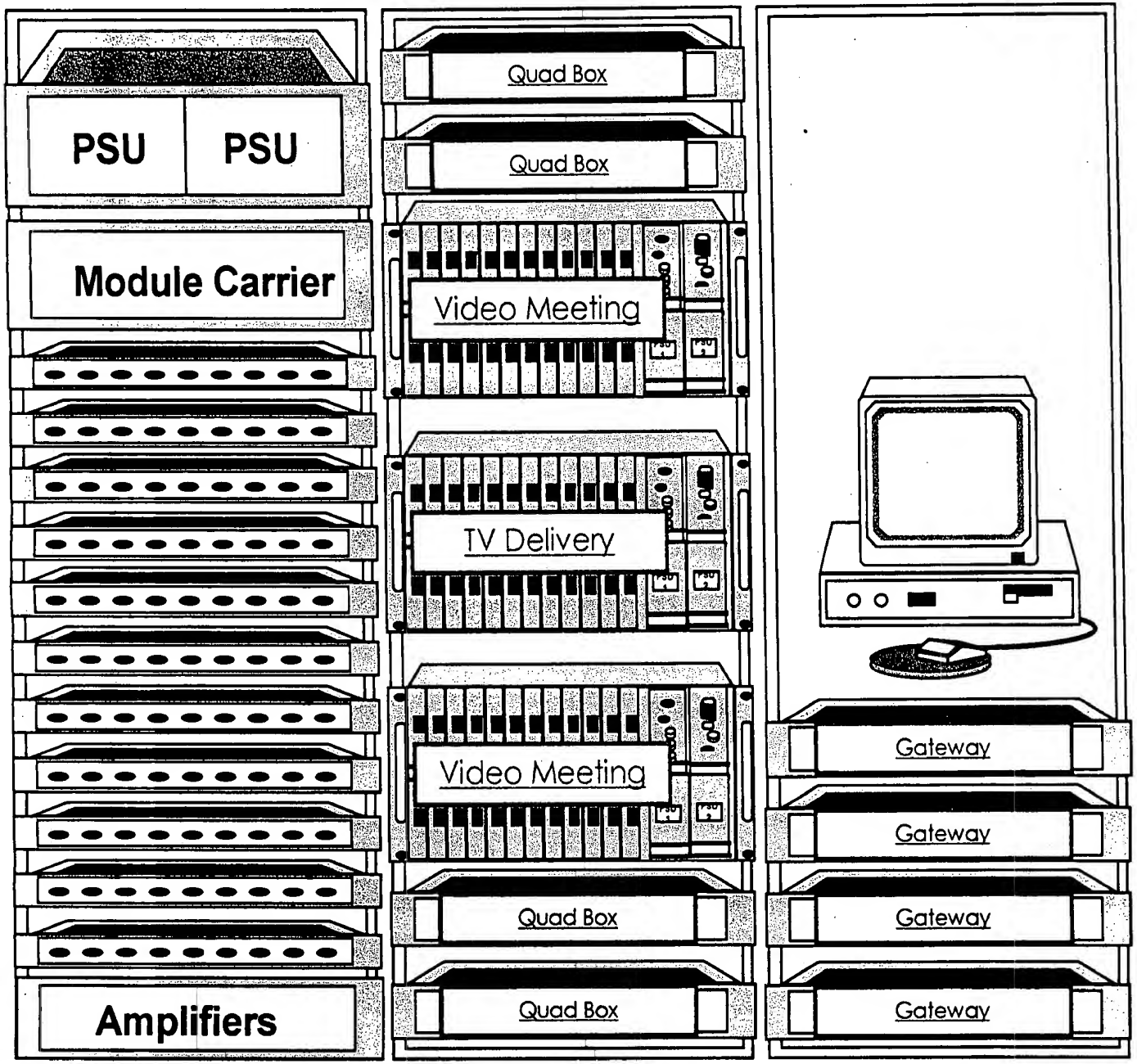
Item	Specification
Television System	NTSC (3.58 MHz , 4.43 MHz) , PAL, SECAM
Power	AC 120 ~ 240 V ±10% 50/60 Hz
In-rush current	30 A max
Power consumption	240 W (246VA) <standby mode 2W>
Display Panel	
Number of pixels	640 (horizontal) x 480 (vertical)
Pixel Pitch	0.66mm x 0.66mm
Display dimensions	16.65 (W) x 12.44 (H) (diagonal 21) inch
Display colors (Video)	16.78 million colors (RGB each 256 hues)
Display colors (RGB)	16.78 / 2.09 million colors (selectable)
Display luminance	96 cd / m^2 TYP (at APL 15%)
Contrast ratio	more than 60:1 (measure in darkroom)
Viewing Angle	Minimum 160°
Display frequency	
Horizontal frequency	15.73 ~ 37.90 KHz
Vertical frequency	50.0 ~ 75.0 KHz
Dot clock	32 MHz maximum
Dimensions	
Display Unit	
Width	20 inch
Height	16 inch
Depth	3.23 inch
Power Supply unit	
Width	3.23 inch
Height	10.24 inch
Depth	14.37 inch
Weight	
Display unit	11.5 kg (25.33 lb)
Power Supply unit	4.5 kg (9.91 lb)
Environment (Operating)	Temperature : 0 to 40° C (32 to 105° F) Relative Humidity : 20 to 80 % (non-condensing) Pressure : 800 to 1114 hPa
Environment (Non-Operating)	Temperature : -15 to 60° C (5 to 140° F) Relative Humidity : 20 to 80 % (non-condensing) Pressure : 800 to 1114 hPa
Fan assembly	
Display Unit	2 pcs : 10.59 CFM / unit
Power Supply Unit	1 pc : 9.00 CFM

6.4. *Video Meeting System / TV Delivery*

The Video Meeting system as outlined in the initial proposal allows a great degree of flexibility for system configuration. As stated already, a detailed site survey and questionnaire will ensure that the customer requirements are understood before any system configuration and project plan are agreed upon. This survey will investigate specific user requirements as well as determining the type and number of feeds to the TV Delivery chassis. A full system specification detailing physical and electrical characteristics and project plan will be provided at that time.

Outlined below is a configuration proposal for the volume of seats and WAN connections specified.

HEAD-END VIDEO MEETING / TV DELIVERY



NOTES

C-C-C
(USA) INC

1227 OLD WALT
WHITMAN ROAD
MELVILLE
NY 11747

TEL:- 516-547-8888
FAX:- 516-547-5566

TITLE:
Video Meeting
TV Delivery
Head End

DRG. No: -CAB-02
ISSUE: DATE:
NOT TO SCALE

7. REQUIREMENTS FROM

Competitive pricing for Compaq equipment.

NT Development software incorporating licensing.

- Visual C++
- Debugging Tools
- Developers Network Level 4 upgrade from Level 2
- GUI RAD tools
- Back Office, SQL Server

Access to appropriate software engineers and Technical Support helplines.

ALL Cabling infrastructures and cabinet requirements as detailed in Section 6.

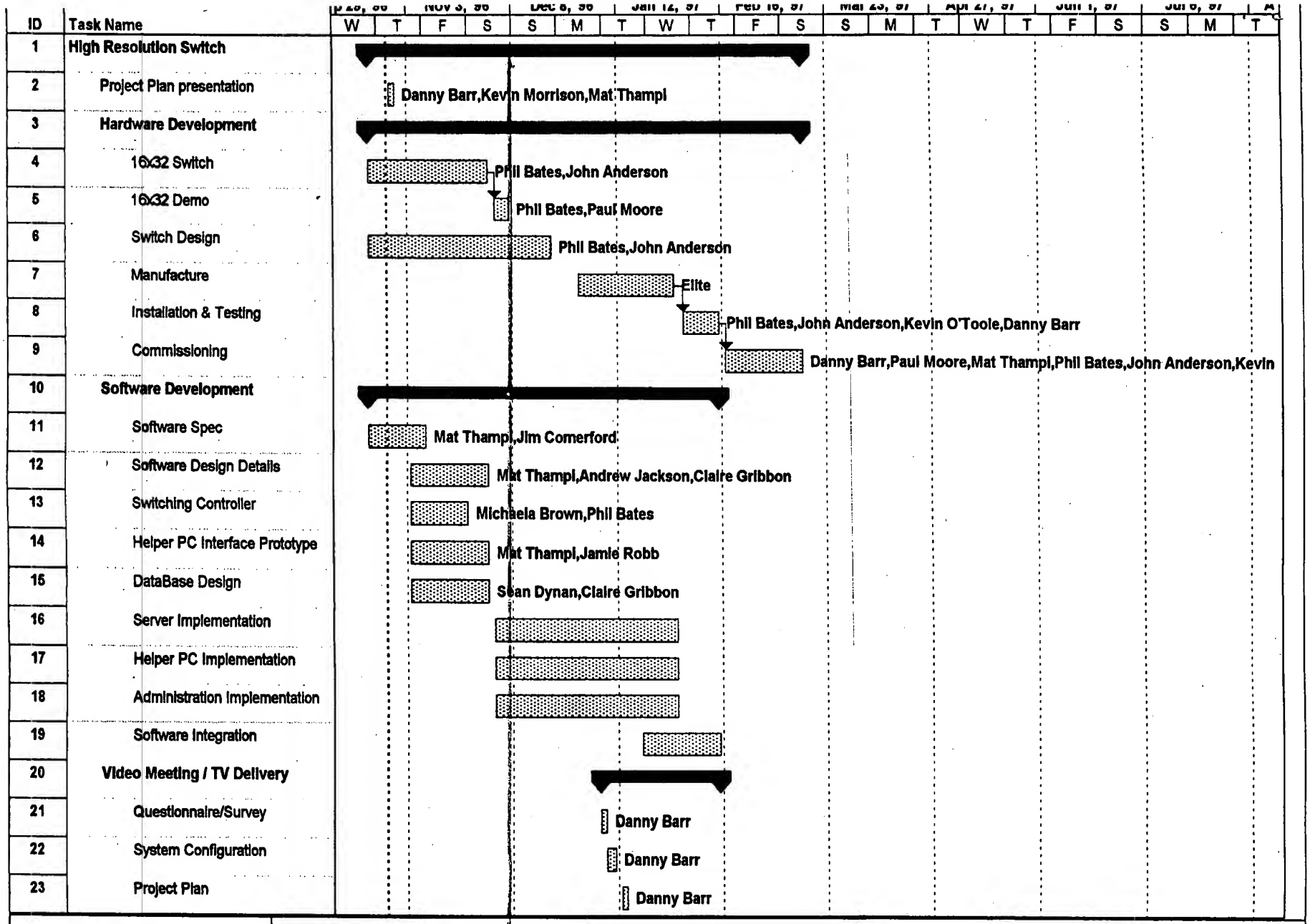
Necessary soft copies of Building Plans and floor layouts.

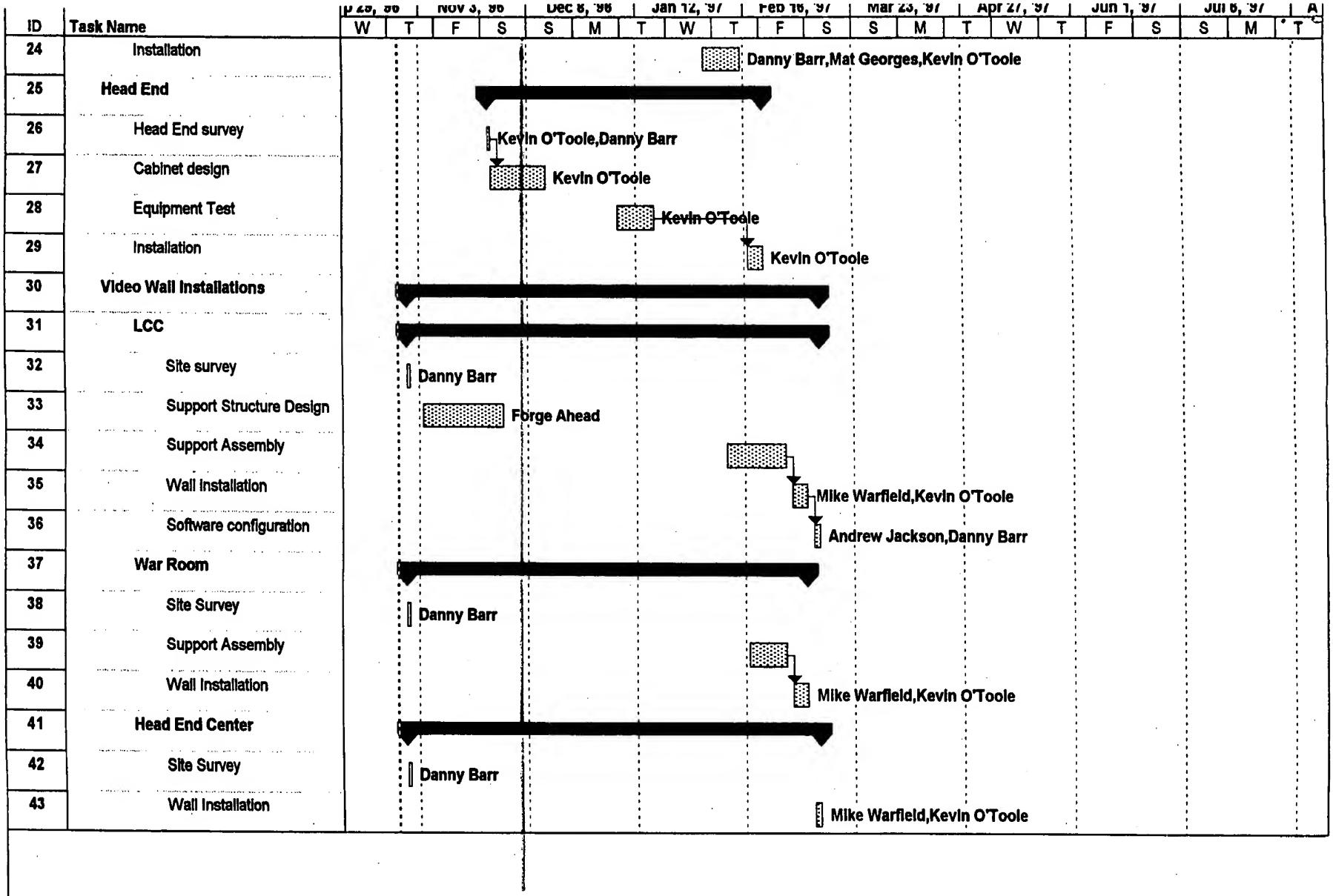
Security passes for all appropriate C-C-C staff including 24 x 7 access which will be required during various phases of development, installation and commissioning of the entire system.

On-site temporary locations for C-C-C Staff during installation and testing commencing 01 February, 1997.

8. PROJECT PLAN

Refer to attached Gantt Chart for detailed project scheduling and relevant milestones.


ID
Task Name
W T F S S M T W T F S S M T W T F S S M T
1 High Resolution Switch
2 Project Plan presentation
Danny Barr,Kevin Morrison,Mat Thampi
3 Hardware Development
4 16x32 Switch
Phil Bates,John Anderson
5 16x32 Demo
Phil Bates,Paul Moore
6 Switch Design
Phil Bates,John Anderson
7 Manufacture
Elite
8 Installation & Testing
Phil Bates,John Anderson,Kevin O'Toole,Danny Barr
9 Commissioning
Danny Barr,Paul Moore,Mat Thampi,Phil Bates,John Anderson,Kevin
10 Software Development
11 Software Spec
Mat Thampi,Jim Comerford
12 Software Design Details
Mat Thampi,Andrew Jackson,Claire Gribbon
13 Switching Controller
Michaela Brown,Phil Bates
14 Helper PC Interface Prototype
Mat Thampi,Jamie Robb
15 DataBase Design
Sean Dynan,Claire Gribbon
16 Server Implementation
17 Helper PC Implementation
18 Administration Implementation
19 Software Integration
20 Video Meeting / TV Delivery
21 Questionnaire/Survey
Danny Barr
22 System Configuration
Danny Barr
23 Project Plan
Danny Barr
Project:
Date: Sun 10/27/96
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress



Project:
Date: Sun 10/27/96

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

9. COMMERCIAL MILESTONES

Stage 1 - October 11th to 28th October, 1996
Payment terms - 10% of contract value due on 28th October, 1996.

Confirmation of briefing and presentation of completed system descriptions for both hardware and software on video switch and other development items on the project plan.
Presentation of basic GUI operation of the video switch system.
Presentation of basic FreeWall control GUI for single scaling engine.
Further analysis of software specification by software project team leader.
Presentation of biographies of project team.
Finalize physical and electrical specifications for each element of the project with ComGroup.
Present project plan and commercial milestones.

Stage 2 - 29th October to 30th November, 1996
Payment terms - 25% of contract value due on 30th November, 1996.

Present actions from previous milestone as required.
Present completed software design and documentation.
Present prototype of Helper PC selection screen
Present completed database Structure design and documentation.
Present and demonstrate a 16x32 high resolution video switch prototype system
Present the order confirmation of ordering of high bandwidth chips, power supplies and other long-lead time components.
Present order confirmation of all flat panel plasma displays and mounting framework.
Present confirmation of C-C-C software personnel commencing main project development.

Stage 3 - 1st December to 31st December, 1996
Payment terms - 25% of contract value due of 31st December, 1996

Present actions from previous milestone as required.

Software
Present confirmation of software development on **Main Server Implementation** which includes *Key Press Monitor, Initialization Module and Helper PC Availability Module*
Present confirmation of software development on **Helper PC Implementation** which includes *Security Authentication, Login Display and Working Available Server Display.*
Present confirmation of software development on **Administration Module** which includes development of *Interface Prototype*
Present confirmation of GUI development for VideoWall multi-scaling video engines.

Hardware
Present complete hardware design including board layout, Gerber files and other associated documentation.
Present design and documentation all cable assemblies for inter-connect systems and desk receivers.
Present confirmation of all orders placed for board manufacture, short lead time components for PCB and cable assemblies.

Stage 4 - January 1st to January 31st, 1997
Payment terms - 25% of contract value due on 31st January, 1997

Present actions from previous milestone as required.
Present confirmation of manufacturing on all circuit boards, assembly, QA testing and burn-in of all system components.
Present confirmation of manufacture on all cable assemblies for inter-connect systems and desk receive units.
Present final testing documentation and client acceptance of all software modules including Main Server, Helper PC, and Admin Module and multi-scaling Videowall engine software.

Stage 5 - February 1stth to March 15th, 1997
Payment terms - 15% of contract value due on 15th March, 1997

Present actions from previous milestone as required.

February 1st-14th
Delivery of all hardware and software to RedWest by 1st February, 1996.
Begin initial cabinet preparation and testing for Video Switch system.

February 14th- March 15th
Installation and commissioning of all TV, Meeting, Wall and Head-End transmit electronics.
Installation of Videowall framework and mounting of plasma screens.
Installation and commissioning of desk receive units on a scheduled basis.
Installation of GUI software on servers and Helper PCs.

Full system testing and commissioning.

Delivery of hand-over documentation and training of all appointed system managers.

Project sign-off by and C-C-C.

C.C.C (U.S.A.), INC.
1227 Old Walt Whitman Road
Melville, NY 11747

Voice: (516) 547-8888
Fax: (516) 547-8886

C-C-C

Invoice

Invoice Number: 1870

Invoice Date: 10/14/96

Page: 1

Sold To:

Customer PO	Payment Terms	Sales Rep ID	Due Date
	Per Agreed Payout Schedule		

Description	Amount
	359,245.00
Deposit: 10% of total contract value	
-- Payment due upon presentation of project schedule, agreed system specifications, and agreed payout milestones document, currently scheduled for October 28, 1996.	

Sales-order 332,019.40
WA tax 27,225.60
359,245-

paid this amt

Subtotal	359,245.00
Sales Tax	
Total Invoice Amount	359,245.00
Payment Received	0.00
TOTAL	359,245.00

Check No:

EXHIBIT 4